TRANSACTIONS

AND

PROCEEDINGS

OF

The Victorian Institute

FOR THE

ADVANCEMENT OF SCIENCE.

FOR THE SESSIONS 1854—1855.

MELBOURNE:
Published for the Society by
GEORGE ROBERTSON, 85, COLLINS STREET.
1855.

MELBOURNE:
Goodhugh & Trembath, 48, *Flinders Lane, East.*

ADVERTISEMENT.

The Transactions of the Victorian Institute include a collection of Papers on various subjects, more or less intimately connected with the present condition and requirements of the Colony, chiefly by writers who have devoted special attention to the several subjects.

The objects for which the Institute was founded, has been held in view throughout, viz.:—to investigate the resources of the Colony of Victoria, and to contribute to their development; and to inquire into the wants of the community with a view to their supply.

In order to extend the utility of the various papers, they have been written in as popular a style as the subjects admitted, so that while they embody the scientific and professional details resulting from particular investigations, they are yet calculated to furnish abundant interest and information to the general reader.

The volume contains, in addition to the above-mentioned treatises, abstracts of the Proceedings of the Institute at its meetings; containing the discussions on the subjects of the papers, and the oral reports made by the Members of the discovery of new Natural Products, &c.

In order to make the work of general public utility, the Council has resolved on printing a limited number of copies beyond the supply required for the use of Members, and on publishing them at such a moderate price (viz., fifteen shillings) as will just reimburse the Society for the cost of publication.

PREFACE.

The Victorian Institute for the advancement of Science, whose Transactions compose the present volume, was founded in July, 1854, for the purpose of bringing together persons whose attention was devoted to scientific observations and particularly to those branches of investigation that were calculated to bear directly on the advancement of the Colony of Victoria. At its meetings many such subjects were entertained, observations recorded and discoveries reported. The collected results are now laid before the Members; the papers which were read to the Institute are published entire, and an abstract of the Proceedings of the meetings is appended. The Victorian Institute was, in June, 1855, amalgamated with the Philosophical Society, and the combined bodies now form the Philosophical Institute of Victoria, whose future Transactions will form a distinct publication.

Wm. Sydney Gibbons,

Honorary Secretary.

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INAUGURAL ADDRESS,

DELIVERED BY

MR. JUSTICE BARRY, PRESIDENT OF THE INSTITUTE,

AT THE

OPENING CONVERZAZIONE, 22nd SEPT., 1854.

LADIES AND GENTLEMEN,—

The object for which we meet this evening is to inaugurate the VICTORIAN INSTITUTE.

We assemble in the vestibule of the Temple of Science, many of us unacquainted one with the other, invited to engage in a course of mutual improvement, and to assist in the cause of general instruction.

The invitation is one which it does not become us to slight; it holds out not only the certainty of much agreeable mental recreation, but also the means, if duly employed, of attaining and diffusing many substantial benefits. It affords an opportunity to those who become members of collecting materials and interesting facts respecting the multitudinous subjects which form topics for the rational inquirer, and to which careful and well regulated observation will attach an accredited worth; of arranging and collating them so as to

facilitate investigation and attract the attention of those competent to exercise thereon an enlightened judgment; of provoking opinions or theories which may at least test the intrinsic merit of those heretofore current; and of recording, in authentic form, the discoveries or speculations of those who have hitherto individually in private prosecuted their unobtrusive studies, simply for the enjoyment yielded by the pursuit, and of those who may now be stimulated to join in giving their thoughts and views a public circulation.

The occasion appears to be propitious for the success of such an institution. This is not an era which will tolerate the division of acroatic* and exoteric learning, or recognise barriers within which the unintiated are not permitted to encroach; men are no longer content that the search for knowledge should be delegated to the exclusive charge of any particular body, involved in the frivolous niceties of alchemical empiricism; clouding in allegory or shrouding in mystic symbols the steps by which they, as they supposed, approached the secret of the philosopher's stone, the elixir of life, or the universal solvent;—no longer amused with the acuminated subtleties of metaphysical disquisitions, dogmatic theology, or philological dissertations. Theories are not now dozed over for a lifetime, to pass away as idle dreams. We live in an age in which the difficulties which arrested the profoundest masters of antiquity and drew forth desponding lamentations of the impossibility of their solution, or ambiguous prophecies† of the probability of their removal,

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* Aristotle classified his Lectures as—1st, acroamatic, acroatic, or esoteric; 2nd, exoteric. The latter, delivered in public, comprised logic, rhetoric, and economics, &c. The former, to which his select disciples alone were admitted, related to the Deity, being nature, &c.

† Vide Bacon, *especially* "Nova Atlantis, Magnalia Naturæ." One of the least oracular and most poetical of these is that well-known passage from Dr. Darwin:—

> Soon shall thy arm, unconquered Steam afar
> Drag the slow barge, or drive the rapid car;
> Or on wide waving wings expanded bear

have been subjugated by the ever-strengthening arm of Science: in which tangible realities and practical demonstration, from what order soever they may emanate, are accepted and appreciated; and in which each one who can add to the treasury, and enrich it with a new idea, or shed a ray of light upon any of the obscurities which deface the disk of learning, will be acknowledged as a benefactor and hailed as a good and faithful servant in the cause.

Moreover, this is an age of which the tendency is not, as formerly, to meet a novel proposition with a contemptuous denial, or its author with an accusation of atheism, intimacy with the Father of Evil, or the yet more heinous offence of heresy, and expose him to the hemlock,* the dungeon, or the stake. The custom of denouncing and decrying innovations as such no longer reigns despotic. We are no longer oppressed by a bigotted veneration for "the wisdom of our ancestors." It is received with a deferential respect, and regarded in relation to the lights by which they were illuminated. New doctrines and inventions are submitted to dispassionate investigation before they are wholly condemned; if found to bear the tests applied, they are readily approved and adopted,—if not in the land in which they originate, in some more congenial spot, among some more liberal spirits; and are made fulcra on which a thousand anxious minds rest their levers to propel into a fuller growth the germ from which they have sprung. The dignified modesty of true

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The flying chariot through the fields of air.
Fair crews triumphant, bearing from above,
Shall wave their fluttering kerchiefs as they move;
Or warrior bands alarm the gaping crowd,
And armies shrink beneath the shadowy cloud.

* Humanity must mourn and the Muse of History must blush while the names of Socrates, Galileo, Faust, More, Servetus, &c., stand on record; and the persecutions of the Christians, by the fierce Nero, the cruel Domitian, the *virtuous* Trajan, the *just* Adrian, the *pious* Antonine, the ambitious Severus, and the indiscriminate fury of Maximin, Decius, Valerian, Diocletian, Maximinian, Galerius, &c.; and of each other by —— But let not the wounded bleed afresh.

learning is conscious that it is only by slow and painful steps that man has been able to evolve and eliminate those portions of knowledge with which he has been allowed to make himself acquainted; and while it will not suffer the self-sufficiency of ignorance to dictate that which reason must repel, it will not allow the arrogance of sciolism to assert that nothing has been left for the present generation to acquire.

Not only on such abstract grounds, but for reasons of a more particular nature is the occasion favourable.

One of the humblest races in the gradation of the human family has yielded to us the possession of the vast territory over which our people are now dispersed, and, by an inscrutable regulation of Providence, is waning before the access of civilization. By exertions unassisted from without, cities and towns have sprung up of a class and with a rapidity which challenge a parallel in former or contemporary history. The events crowded into the last three years have wrought a change, not merely in the actual condition, but in the immediate prospects of our community, which, as regards our social and political state and the opening dawn of accelerated progression, must inspire consolation, confidence, and hope. The discovery of gold, happily postponed until our hills, plains, and valleys were covered with flocks and herds, and until we had emerged from dependence upon, to that of sisterly amity with a province, has brought us into direct intercourse with nations hitherto indifferent to, perhaps ignorant of, the geographical position of this country; the keels of whose stately vessels now furrow every sea to visit us, who exchange with us commodities, productions of every clime, and pour forth their hardy sons to reinforce our numbers, bearing with them practised skill and restless avidity for the acquisition of wealth. The enterprise of our great parent state, but languidly expanding under pastoral occupations, has been caught up, and now directing itself into innumerable fresh channels, gives indication of highly vital force. Each new scientific application to

economise labour and time is brought within our reach, opening new avenues to honourably earned riches, and unattended by any of the inconveniences which in over-crowded communities occasionally arise from the substitution of machinery for manual labour before the classes affected thereby have resorted to other occupations; and we may be well assured that there are amongst us many gifted men of cultivated minds, fervid imagination, and intrepid temperament, who, curbed and confined elsewhere by the pressure of surrounding competition, have panted for a field in which their talents may be allowed to expatiate, and have gladly turned to this young country ready to receive them with a gracious welcome.

The construction, the features, the products, the deficiencies, the wants of this country demand and must exact scientific innovation to suit, adapt, repair, or supply it and them; and if within the recollection of some present a FULTON, unestimated in his native city, lived to see his baffled projects ripened in a foreign land, and the waters of the western hemisphere crowded with vessels incessantly propelled by the impulse of a slighted mechanism and a distrusted might, is it presumptuous to imagine that this genial southern sun may hasten into birth some unrevealed combination of forces, the rudiment of which as yet lies in the brain of one amongst us hitherto unsmiled on by the favour of his own compatriots, ungladdened by the approving voice of his own countrymen?

This is surely, then, a time when every effort to rivet attention on the culture of Art and Science should be heartily seconded. A strong desire for knowledge is manifested in the foundation of our University, the establishment of Libraries, and the formation of the numerous societies springing up in our towns, their suburbs, and the more distant districts. All this points to prove that the barren acquisition of money does not satisfy the cravings of a

people who possess a comprehension beyond that of the method of acquiring it, and that if such an appetite be once created, that people will demand something more than simple didactic information.

As to the benefits to be derived from the establishment of this institution, they are incalculable, and an attempted enumeration of them would be alike unnecessary and incomplete. What rather must they not be when an account of the natural and physical resources of the country is untouched by any hand we may strictly call our own?—when the different branches which treat of the mineral stores hidden within the earth, the vegetation which luxuriates, the insects, reptiles, animals which move upon its surface, the fish which swim in its waters, the fowls which float in its air, invoke especial systematic notice?—when the annals of atmospheric and climatic changes continue unnoted, and when a faithful narration of the few but eventful years of the occupation of this soil by Europeans is unwritten?

It must, however, strike you obviously as of no inconsiderable moment that an organized body should exist, round which those ardent in the pursuit of Science, and zealous in unfolding its enlarged adaptation to the peculiar wants of this country, should be able to group themselves; in which they could see the steadfast countenance of recognized authority; in the archives of which they could find the large stores which sagacity and unwearied diligence have laid up in hours saved from tedious indolence or snatched from profitless self-indulgence, to quicken intelligence and incite to that ambition which extorts praise; and where they may encounter that variety which will afford a chord on which each distinctive mind may strike its ample tone, lend a completeness to the full diapason, and thereby enliven and relieve the exact and monotonous uniformity.

One solid advantage to be reaped, were that the only one, is that by the practice of original investigation, the intellect

will become fertilized; and as by ploughing and harrowing the soil, new elements of vegetation and reproduction are brought to the surface, such exercises will imbue the mind with an elasticity and a capacity for analysis and induction, enlarged as occasion presents new objects with which it is called on to grapple.

This is by no means an unimportant consideration while the printing press is daily sending forth works written with the fascination of what is termed a popular style, introducing every species of scientific question, stripped of all severity of demonstration. When readers once acquire a habit of perusing such works hastily and without method, indiscriminately and without reflection or the necessity for mental exertion, they become prone to lean on the memory rather than to rely on the understanding, thereby underrating and necessarily impairing the higher powers of reason. Those who are satisfied with a medium so acceptable to the indolent may be displeased with what they may deem a depreciating allusion to such books. It is not my desire to undervalue, but to stamp a right value upon them. Many of them are of considerable merit, and the authors of them have distributed much useful instruction in quarters to which it had never before been able to penetrate; but in adverting to one of the chief aims of this Institute, "the elevation of the intellectual condition of the community," it is my wish to impress upon its members that this is not to be accomplished by adopting second-rate philosophy at second hand, but by enforcing the necessity for primary research; by creating a taste for independent and thoughtful observation; by gratifying the powers of perception while the attention is engaged and the curiosity gratified; by urging its members to strike out for themselves a track different from that which can only lead to mediocrity; by enlisting the active and strenuous, fostering in them a vigorous and self-relying habit, and thus, by strengthening the strong, arousing the listless and in-

attentive; and having kindled such a spirit, using every means to make it to permeate through every grade.

That such consequences may be looked for is probable when we consider that labour, whether physical or intellectual, is eminently social, and always most effective when combined; yet, that the achievements which human industry has made conspicuous have been won, not always by the combination of many hands, but by the co-operation of many minds, and the accumulated experience of many men.

In the elaboration of each separate idea a compensating mutual relation with some other cognate idea is found which brings a fresh agency to bear upon, assimilate, or clash with it; such attrition, different from that which wastes and diminishes physical bodies, serving to sharpen and refine the mind, correct, enlarge, or perfect the idea. A mutual dependency of powers, faculties, and functions is also an interesting feature in labour, through which arises the reflection of itself upon itself, and the reaction of the votaries upon each other.

The philosopher would be helpless without the assistance of the mechanic, who furnishes him wherewith to pierce through space beyond the range of human ken; to measure the heavens as with a meteyard; to trace the erratic course and predict the occultation and reappearance of the comet; to calculate with unerring certainty the effect of every perturbation arising from the constant, yet change-producing influence of gravitation; to weigh the invisible air, and to note the delicate organism of microscopic animalculæ.

The navigator, the engineer, the chemist are alike indebted to him; while on the other hand, the useful arts would stand still, the mechanic be no more than the primitive artificer, were it not for the successive substitutions or additions of forces, economical or supplementary, to construct which genius informs him; and his hand would be confined to the repetition of that labour which has no excitement of novelty, and is unrelieved by the prospect of improvement.

Thus Science claims Art as its handmaiden; Art reverences Science as her preceptor; each knit to the other with a benevolent sympathy.

In seeking to acquire an intimacy with the secrets of either, even in the seemingly motiveless or injudicious study of them, some collateral or accidental good may be expected, while from the neglect or unwise disregard of them nothing can proceed but regret. Although the great truth may lie beyond our reach, the honest and painstaking search for it may profit much; although the investigation may fail to reach the ultimate goal of his wishes, he may be entertained by many a pleasing diversion on the way.

Discoveries the most memorable have arisen accidentally and almost unbidden. The stain left on the lips of a dog, which had feasted on an insignificant shell fish, drew attention to that dye* which tinctured the robes kings and conquerors were proud to wear. We are told that some Phœnician sailors having, for want of other fuel wherewith to cook their food on the sea-shore, had recourse to some blocks of alkali with which their vessel was laden, were astonished to behold it, when acted on by heat, dissolve into translucent streams, and assume with the sand the undesigned form of vitrification, giving the first hints for the manufacture of glass, now so indispensable an article of use, ornament, and luxury. The fatal efficacy of gunpowder as an agent for the destruction of human life surprised the cloistered Bacon. The mirthful disporting of the children of an obscure spectacle-maker of Middleburg, who, by placing two pieces of glass one before the other, and looking through them, observed the weathercock on a neighbouring steeple to be magnified, drew the notice of the father to the fact; who, struck by the singularity of the effect, adjusted lenses on a

* Purple.

———Tyrioque ardebat murice lœnâ,
Demissa ex humeris.

i. e., of the Pious Æneas.—*Virg. Æn. IV.*, 263.

board in brass rings, moveable at pleasure,—the first rude attempt at the telescope, the instrument which has so effectually aided to establish the renown of NEWTON, LA PLACE, and HERSCHEL. The spasmodic convulsion of the limbs of a dead frog, caused by the unpremeditated contact with two plates of metal, exposed to GALVANI the premises on which, by a series of successful experiments, he built up the principles of Animal Electricity. While many of those by which Chemistry has administered so extensively to the convenience and efficiency of medicines, by removing nauseating or pernicious substances, or to ennobling the arts by disclosing previously unknown properties in vegetables, minerals, acids, or alkalies; in fixing or liberating colours; in ascertaining the composition and affinities of the different gases; have almost, as it were, obtruded themselves obliquely, —and the unappropriated ideas which the surge of everflowing time casts upon its bosom have thus allowed themselves to be drawn within the eddying verge of that circle which the inquirer has disturbed.

But to turn and view the subject in another light. There is no slender enjoyment afforded by the ready concession made by intellectual liberality to a demonstration, however startling, which stands in direct contradiction to traditional error, to the immature offspring of crude theories which we have too readily accepted from others, or to the cherished conclusions which we may have rashly drawn from ill-considered or assumed data; and the celerity with which after the evidence has been understood and assent granted to the new proposition, all pre-existing notions are displaced—and the tenacity with which the belief clings to the latter doctrine, by which the former has been supplanted, prove incontestibly the natural and indwelling love of truth which predominates over every other impression on the heart and mind.

Are there not, however, other attractions besides those emphasised by utilitarian argument capable of luring us t

such an enlightened species of amusement; to the devotion of a portion of that leisure left after the performance of our sterner duties, to prepare us for the perception of a more refined description of intellectual recreation than we have hitherto had within our reach?

It is too common to treat Science as ascetic and austere, and deny to her the ability of unbending to animate and to please. You recollect the enthusiastic apostrophe of the poet, who exclaims, with a greater generosity, to which I hope I hear an echo:—

> "How charming is divine philosophy!
> Not harsh and crabbed, as dull fools suppose,
> But musical as is Apollo's lute,
> And a perpetual feast of nectar'd sweets,
> Where no crude surfeit reigns."

Who, then, is so impassive as not to feel delight in dwelling on the vast design of Nature, the order and beauty with which it is maintained, and yearn for an insight into its great arcana? Whether we survey the celestial scheme which prescribes to planets and their satellites stated revolutions, and upholds all, without dislocation of the marvellous mechanism, producing in the infinitely diversified movements of its members, by an all-wise counteraction of discordant discord, such surprising harmony; or whether we behold the terrific wonders of the atmosphere torn by devastating hurricanes, or agitated by conflicting currents, laden with pestilence, dealing death around; or its soothing airs breathing life and health. Whether we study the structure of the solid globe, and the alterations it constantly undergoes, by the agency of heat or magnetism, or those subtile powers which generate the volcanic shock, and work the perpetual transmutation of its compact ingredients; or the properties of elementary substances, their union and reciprocal action; or the structure, development, and admirable adaptation of the vegetable and animal kingdoms, ascending in unbroken

series to man; whether we look around and behold the curious felicity of his inventive genius, through which he has gained a mastery over the resisting elements, the stubborn earth, the treacherous ocean; and made the explosive steam, and the "thwart flame" of the "slant lightning" ministers obedient to his behests; or the perseverance of his unremitted toil, by which he has reared in every zone monuments of his piety, his ambition, his ostentation; or the fertility of his aspiring ingenuity, by which he has increased his sources of comfort, and encumbered the field of enjoyment with the prodigality of his luxury; or, finally, whether we cast our thoughts inward on ourselves, and consider the constitution and operations of the mind, the working of the passions, the sway of the affections, the faculties of the understanding, the dominion of the reason?

These afford themes which will for ever create fresh interest; for ever yield new gratification; for ever mock the efforts of the human race to exhaust them. From these as the elegant relaxations of our prudently husbanded vacation, we may harvest riches which neither birth nor fortune can confer, which neither poverty nor the vicissitudes of adversity can take away.

If it be necessary to adduce further reasons, besides those indicating the good results expected to follow on the establishment of this Institute, let me call your attention to what is going on elsewhere, without the boundaries of our immediate range of action; amongst other nations, with whom, in the charities of Art and the catholicity of Science, we may claim kindred. Every department of Philosophy is marching onward with gigantic steps, each stride elongated beyond the last. Every year teems with some new disclosure respecting the phenomena of nature, and the laws by which they are governed. While HUMBOLDT, eminent for the remarkable diversity of his matured knowledge, is endeavouring to prepare his Cosmical sketch of Creation, he finds himself outstripped and forced to pause, that he may append

by supplemental annotation to each part as it issues forth, the results of that inductive reasoning, which, carried on by simultaneous yet independent study, has enabled a LE VERRIER and an ADAMS to herald the existence of new worlds, undetected by the inquisitive astronomer; and of the patient meditations of other men, who have spread out before him unimagined wonders. Methods of treating abstruse topics are simplified; improvements in the instruments to assist philosophical investigation, succeed each other to an extent which, while they excite a just admiration, hold out a belief that we are hovering on the threshold of more astounding discoveries than any which have hitherto awed us by their sublimity, or gratified us by the practical usefulness which has tended so extensively to the civilization of mankind.

And is it for us to lag behind, in the race in which the sages of our time show us such an example of diligence and activity? Is it to be said of us, the tenants of a portion of one of the grand divisions of the globe—a storehouse of unrevealed mysteries—the theatre, we may presume, of future great actions—that we have no ambition but to vegetate on its surface, mere "air plants whose roots are the lungs," (as Novalis quaintly terms men) without even contributing our quota of information respecting those things daily exposed to the observing eye, or endeavouring to awaken an appreciation of their concert, or aspiring to add a sign to the zodiac of science?

Are we to waste life in frivolity, or in occupations which, when we perish, will leave no memorial even of our own existence; and allow our era to be cited as that of the Cimmerian obscurity of the Southern Hemisphere? Are we to shrink from solving our portion of the great problem of truth; or is it apprehended that the grandeur of the theme should repel, that we should doubt our powers, distrust our endurance, and be fearful for our success?

Such timorous diffidence, such unworthy distrust, are un-

becoming, and ought not to be suffered to interpose the fluctuation of a wavering instant; and even were there grounds to apprehend a want of vigour to sustain this Institute, I would say:

> Yet where an equal poise of hope and fear
> Does arbitrate the event, my nature is
> That I incline to hope, and not to fear.

It will not, I feel assured, have escaped the reflective amongst this audience, that of such pursuits as those on which we are about to engage ourselves, the chief end should be, not merely to extend our acquaintance with matters or things, their qualities or accidents; or to waste time, however sedulously employed, if our efforts merely entitle us to the barren praise of skilful compilers of dry and isolated facts, or unwearied classifiers of characteristic peculiarities or attributes, ingenious nomenclators, or editors who work on the volume of Nature as a Dictionary; but that our faith is to learn their relative value, in subordination to the comprehensive scheme of creation: and by exalting the understanding, waft it above the cheerless sophistry which chains the soul to an empty materialism, and warm the affections towards the great Author of Being. When we acknowledge that to be the needle which guides our speculations, we will be perpetually reminded of that infinite wisdom which governs and regulates the orb on which we dwell; but one amidst the countless myriads of worlds which Divine intelligence holds within their spheres; and, looking "from nature up to nature's God," muse with admiration and humility upon the system to which we owe so many blessings, and the succession of those indissoluble links which connect us with immortality.

We may then, in sincere approbation of the sentiments attributed to our first parents, in the simplicity of their uncorrupted state, join in these enthusiastic exclamations:—

These are Thy glorious works, Parent of Good ;
Almighty ! Thine this universal frame,
Thus wondrous fair : Thyself how wondrous then :
Unspeakable! who sit'st above these heav'ns.
To us invisible, or dimly seen
In these thy lowest works : yet these declare
Thy goodness, beyond thought and pow'r divine.

II.

A FEW OBSERVATIONS ON THE COUNTRY NEAR LAKE TORRENS.

READ BY MR. F. SINNETT.

26TH SEPTEMBER 1854.

EVERY one who knows anything of Australian geography, must have observed upon the map the strange horse-shoe shaped lake that is indistinctly shadowed forth; and that appears to form a sort of natural northern boundary to the neighbouring Colony of South Australia. The lake when I visited the district, was but little known, and is but little known now. The outer shore of the horse-shoe lake has been seen by but few persons, except at the extremities. But one party ever actually reached the water from the outside;—this was a small detachment from the exploring party commanded by Captain Sturt, the detachment being

headed by Dr. Browne, the medical officer of that expedition; and who, after the death of the second in command, and during the illness of the leader, became practically the head of the expedition. He not only reached the water, but bathed in it, and so finally disposed of the doubt that long existed as to wheteer the so-called lake deserved the name, or was more than a long strip of desert land, rendered white and shining by an incrustation of salt.

Until the beginning of 1851, the nature of the country lying within the bight or horse-shoe had been completely misrepresented, and a personal knowledge of its true character is still confined to a few. Nearly twelve years before, Mr. Eyre, the late Lieut. Governor of the middle island of New Zealand, had crossed the western horn, at a place then—and usually —devoid of water, but where during floods a torrent rushes down into the head of Spencer's Gulf, close to Mount Aden. I may mention here, that in 1851,—after an interval of twelve years—we found the wheel tracks of Mr. Eyre's party along the banks of a creek which he describes in his narrative, and we also found the traces of one of his encampments at another watering place.

While Mr. Eyre perhaps stands, in the dismal records of Australian geographical research, without second as an intrepid and long-suffering explorer, it has been his unfortunate fate often to pass in the immediate neighbourhood of excellent country without ever lighting upon it, and this was the case in the Lake Torrens District. I attribute his misfortune to an inveterate propensity the brave explorer possessed to adhere to coast lines whenever he had an opportunity. Thus by closely coasting Spencer's Gulf he succeeded in confining his observations to a plain covered with salsolaceous plants and almost destitute of water, while over a broad district, since found to be not only habitable, but in many places highly fertile, he wrote in large letters upon his map that the district appeared to consist of nothing but

barren hills and spinafex ranges. This part is mentioned for reasons that will be presently shown.

Among the "barren and useless spinafex ranges," there are a number of excellent sheep and cattle runs, in most of which an interest is held by Dr. Browne, before-mentioned, and his brother, who have really been "pioneers of civilization" in that neighbourhood, and who have been mainly instrumental in opening up the pastoral resources of the "far north" of South Australia: Among these runs is one characterised by a physical peculiarity that deserves mention.

An extraordinary triangular range of mountains encloses about twenty-five square miles of fertile country so completely as to have won for this strange place the name of "the Pound." The hills are from two to four thousand feet in height, and out of several which I had the honour of naming, two bear the names of members of the Victorian Institute. The only inlet or outlet to the pound is through a narrow gorge, closed up when I last saw it by about a hundred feet of rude fencing, and through which comes a stream that carries away, to lose in the great plains of Lake Torrens, the drainage from the three ranges—a triangular range of hills. The hills are so steep on the inner side that neither man nor beast can climb them, and among the incidents of the discovery of the place, I may mention that two extremely old bullocks, who, I know not how, had found their way into the pound, were disturbed in their monarchy of all they surveyed, and were as wild as if they had never enjoyed the advantage of communication with civilised man. It was their misfortune also to be exceedingly fat, and within a few weeks after their discovery when I first visited the domain of which they had previously held undisturbed possession they were no more.

According to most maps the extreme length of Lake Torrens, measuring round the horse-shoe, from one extremity to the other, is represented at about four hundred miles. I am convinced that this is a considerable exaggeration.

I speak only of the inner bight, for how far the lake may extend to the north-west is at present unascertained. From actual though rough survey, however, I ascertained that even the ten thousand square miles of country were included within the horns of the gigantic crescent.

The area is extremely mountainous, and from the tops of many high hills standing seventy or eighty miles to the northward of "the pound," I have seen the lake stretching like a streak of silver between myself and the horizon, and was convinced that the ordinary account which represents it as but a narrow strip of water is substantially correct. I speak of the North-Eastern, the Eastern, and the Western portions of the lake. The North-Western, as I have said, has never been visited.

Nor is it easy to visit the lake itself from the inner shore at any place except near Mount Aden. Even there in ordinary seasons it would be necessary to labour for at least ten or twelve miles through a sandy plain bearing no vegetation, except a few stunted salt bushes, and totally destitute of fresh water, while nearer to the lake a broad belt of salt incrustation, left by the recession of the water, would, except in the very rare event of a flood, have also to be overcome. Proceeding farther northward and then eastward in a direction more or less parallel to the lake, we found that the farther north we got the wider became the strip of what may be called the Inner Lake Torrens Desert. Thirty or forty miles to the westward of Mount Serle, as we emerged from the hilly country on to the desert, we could see the lake, or its salt banks shining far away to the north, but we estimated the distance to be at least fifty miles, and had no disposition whatever to go further in that direction. From the summit of Mount Serle the lake is again visible to north-east and east—to the east through gaps in mountain ranges—to the north-east without any interruption, except that caused by two conical peaks that stand in strange isolation on the level

plain of the desert, and which from their bearings and apparent distance I conclude to be—or rather that one of them is—the Mount Hopeless of Mr. Eyre. Now is it to be wondered at that he should have so named the hill, or that even his spirit should have been subdued into hopelessness of farther discovery in that direction.

The barrier that is drawn round the district of hilly and inhabitable country separated from Lake Torrens by the strip of desert I have described, is rendered yet more insurmountable by the fact that even those water-courses which towards their sources contain abundance of fresh water become perfectly salt lower down. Thus the creek that runs through the gorge of "the Pound," contains abundance of good water for several miles, but afterwards becomes salt, and finally dwindles away and loses itself before reaching the lake. The Frome River described by Mr. Eyre, and which another of our party and myself descended some distance farther than he appears to have done, serves to illustrate the same phenomenon. Where we first came upon this creek the few holes that contained any water at all contained water that was perfectly good and fresh. Lower down the stream passed through a long gorge in the cliffs, ascending in several places almost perpendicularly for several hundred feet, and with considerable difficulty we followed the creek for about a dozen miles. Though still pent up among the hills, we found the water gradually changing from fresh to brackish, and from that to salt. We did not succeed, as I should have been very glad to have done, in following the Frome until it finally emerged from the hills into the desert plain.

One peculiarity of what may be called the outer circle of hills, running more or less parallel to the inner shore of Lake Torrens, deserves mention. Approaching these from the side farthest from the lake, it is easy to climb them, but on reaching the summit of the range I invariably found steep and inaccessible cliffs facing towards the lake.

I regret that my geological knowledge does not enable me to give a scientific description of a district that I am sure would well repay a visit to a good geologist. One member of our Institute, Dr. Mueller, will, I trust, give us what no one but himself can—for no botanist but himself has been in the neighbourhood—an account of the vegetable kingdom of the Lake Torrens District.

III.

ON STATISTICAL SANITARY PROCESSES.

BY W. H. ARCHER,

ASSISTANT REGISTRAR-GENERAL.

READ SEPTEMBER 26, 1854.

MELBOURNE MUSEUM LIBRARY

THE Council of the Victorian Institute having honoured Dr. Maund and myself with the task of reporting on "Sanitary Processes," and especial invitation having been made to me to initiate the subject this evening, I purpose to show briefly the groundwork on which all sanitary systems in this Colony should be based, or in other words, our PROCESSES of INFORMATION, or how we must get at our facts.

For several years past,—in fact, ever since a Registrar General's Department has existed in London, the public mind in Great Britain and other countries has from time to time been agitated by startling revelations of the prevalence of recurrent forms of disease in certain localities, which seemed to be the very hot-beds of typhus and cholera, and other

diseases of the same hideous family. The public alarm soon manifested itself in the shape of meetings and discussions; and House of Commons' Committees, and Poor Law Commissioners, and Special Sanitary Commissioners appointed by Her Majesty, and Voluntary Commissions in the shape of Health of Towns' Associations, inspected and reported with a vigour,—the good results of which were, and are, certainly lamentably slow in coming about.

It is not my intention this evening, to enter into a detail of the misconceptions in theory and the mistakes in fact, made by the first agitators of the Public Health Movement; I hope on another occasion to have the opportunity of pointing out the rocks on which they split, much to the injury of a good cause. It will be satisfactory, however, to state that we in this Colony are in possession of materials and advantages that they had not, and it will be our fault if the progress of the Science of Vital Statistics should become impeded by unnecessary obstructions.

When I had the honour of being requested by the Government to draw up a general plan of registration, about eighteen months ago; on examining the schedules appended to the Act xvi. Vict. No. 26, known as the Registration Act, I found very important statistical omissions in every one of the schedules. For example, in the MARRIAGE Schedule the AGES of the Bride and Bridegroom were omitted; in the BIRTHS' Schedule, the ages of the Parents, the date of their marriage, and the number and sex of their former children were not asked for; and in the DEATHS' Schedule the duration of the last illness, as certified by a medical attendant was wanting; also, the time of residence in the Colony, and if deceased were married, the period of marriage, and a list of the issue living and dead, with their ages.

Now every one of these points has an importance that can only be duly appreciated by Actuaries, in calculating tables of mortality, and the values of life-contingencies dependent

thereon; and by Vital Statisticians, who have hitherto sought for such authentic information in vain. To the honour of Government, be it said, the suggestions made for the introduction of the above points into the schedules were promptly agreed to, and the consequence is that VICTORIA has commenced a system of registration more comprehensive in its scope and scientific in its detail than any hitherto carried out in any part of the world.

Apart from the legal value of the minute and varied information contained in these and similar returns, there may be made a long list of important scientific results deducible from them, when taken in connexion with the ascertained living population existing at the period for which such returns are made. First, in the Birth Schedule, by the birth-place, age, and date of marriage of the parents, and the number and ages of former children being given, some valuable problems may be solved *for the first time;* for example :—

1. What relation is there with regard to the ages of parents at the time of marriage and the number of after issue?
2. What is the rate of mortality among children generally; and also in family groups?
3. Are male or female children most difficult to rear? and which are the more fatal periods of age for each?
4. What influence has the varying age of the parents over the sex of their children?
5. Is there any, and what, difference in the rate of birth, or mortality, or proportion of either sex in the children of persons of different races, as for example, among the English, Irish, &c.?

From the Death's Schedule, in like manner, may be determined—

1. The healthiness or unhealthiness of the Colony generally, and of specific localities therein.
2. By the causes of death being given, the extent and fatality of each disease may be ascertained.

3. Tables of sickness, mortality, probability, and expectation of life, may be formed for purposes of friendly societies, for life assurances, annuities, reversions, leases on lives, endowments, and other objects of first importance to the community.
4. The influence of occupation on life may be determined.
5. The place of birth and length of residence in the Colony being given, the duration of life of the *advenæ* or immigrants may be found in contrast with that of the native born.
6. By the two last columns furnishing the ages of marriage of parents, and a list of their issue, similar valuable results may be obtained with regard to the rate of mortality among children, &c., and the influence of the parents ages at time of marriage, on the longevity of their progeny; and further, by the number of children shown as living or dead since the arrival of the parents in the Colony, the influence of the climate, &c., on European, or other children born out of the Colony, will be determinable as well as with regard to natives.

From the MARRIAGE schedules, by means of the ages, the birth-place, and the civil and social condition of the parties being given, various questions in relation to the present and future political state of the population can be answered, and additional light is thrown on the path of the Statist in his efforts to arrive at the laws of birth, disease, and death, as they variously affect the different members of the human family.

SCHEDULE A.

1853. BIRTHS in the District of BOURKE, in the COLONY of VICTORIA. *Registered by Thomas Johnson, Deputy Registrar.*
For the Quarter beginning on the 1st day of July, and ending on the 30th day of September.

No.	*Child.*			*Parents.*			*Informants.*	*Registrar.*			*Witnesses.*
				Father.		Mother.					
	When and where born.	Name, *and whether present or not*	Sex.	(1) Name and Surname, (2) Rank or Profession of the Father. (3) *Age, and* (4) *Birthplace.*	(1) *When and where married;* (2) *Issue, living and dead.*	(1) Name and Maiden surname of the Mother, (2) *Age, and* (3) *Birthplace.*	Signature, Description and Residence of Informants.	When registered *and Where.*	Signature of Deputy Registrar.	Name, if added after Registration of Birth.	(1) *Accoucheur* (2) *Nurse by whom certified, and* (3) *Signatures of Occupier or other Witnesses.*
7	Eighth of June 1853, at Little Lonsdale st., Melbourne.	William. (*present.*)	Male	(1) George Fox. (2) Stonemason. (3) *Age,* 50 *years* (4) *Liverpool, England.*	(1) 16*th of May,* 1832, *Liverpool, England.* (2) *Francis,* 12 *Fanny,* 17 *Charles,* 16 *Thomas,* 14 *George,* 12 *Mary,* 11 *Timothy,* 9 *John,* 7 *Betsy,* 4 *All living.* *Arthur,* 2 *Dead*	(1) Mary Fox, Maiden name, Williamson. (2) 44 *years* (3) *Liverpool, England.*	(Signed) George Fox, the Father, Little Lonsdale street, Melbourne.	Sixth of August, 1853, *Melbourne.*	(Signed) Thomas Johnson, Deputy Registrar.	———	(1) *Edward Jones, M.D.* (2) *Mary Jackson, Nurse.* (3) ———

NOTE.—The names of persons and localities are changed, but otherwise the above is a correct copy.

SCHEDULE B.

1853. DEATHS in the District of BOURKE, in the COLONY OF VICTORIA. *Registered by Thomas Johnson, Deputy Registrar.*

For the Quarter beginning on the 1st day of July, and ending on the 30th day of September.

No.	*Description.*			(1) Cause of Death. (2) *Duration of last illness.* (3) *Medical Attendant by whom certified and* (4) *when he last saw deceased.*	Name and Surname of Father and Mother, if known, *with Rank or Profession.*	(1) Signature Description, and Residence of Informant, and (2) *Witness.*	(1) Signature of Deputy Registrar. (2) Date and (3) *Where Registered.*	IF BURIAL REGISTERED.		*Where born, and how long in the Australian Colonies, and which.*	*If Deceased was Married.*	
	When and where died.	Name and Surname. Rank or Profession	Sex and Age.					Ween and where buried. *Undertaker by whom certified.*	Name and Religion of Minister, or name of Witnesses of Burial.		(1) *Where, and at what* (2) *age, and* (3) *to whom.*	*Issue in order of Birth, their Names and Ages.*
1	First of August 1853, at Bourke Street, Melbourne.	Jane Smith, wife of informant	Female. Fifty-seven years.	(1) Hepatitis. (2) *Seventy-eight days.* (3) *Edward Jones, M.D.* (4) *On the thirty-first of July,* 1853.	Name of Father, Frederick Long, *a Boatman, of Scarborough, Yorkshire.* Mother's name, Emma Binns.	(Signed) John Smith, a Printer, residing at Bourke Street Melbourne, and husband of the deceased (2) *Jas. Jones.*	(Signed) (1) Thomas Johnson. (2) 3d of August, 1853, *at* (3) *Melbourne.*	Buried on the 4th of August, 1853, in the New Cemetery, Melbourne. *Burial Certified by George Thompson, Undertaker, Melbourne.*	James Harvey, Minister of the Church of England, Melbourne. Witness of Burial, George Thompson. Undertaker.	*Born at Scarborough, Yorkshire, on the 2d of February,* 1797, *Arrived in the Colony of Victoria, per ship "London," on the 10th of July,* 1852.	*Married at Scarborough, on the 6th of July,* 1825, *at twenty-eight years of age, to John Smith, of Scarborough, Yorkshire, a Printer, aged thirty years.*	*Peter born on 30th June,* 1826. *George born on 30th Nov* 1827. *Jane born on 10th Oct.* 1829. *Thomas born on 19th Oct.* 1831. *Mary born on 12th Aug.* 1833. *Henry born on 29th Oct.* 1835. *David born on 5th May* 1838. *John born on 5th Jan.* 1844. *Died 12th March,* 1845.

NOTE.—The Names and Localities are changed, but otherwise the above is a correct copy.

SCHEDULE C.

1853. MARRIAGES solemnized in the District of BOURKE, in the COLONY OF VICTORIA, *by the Reverend James Harvey.*
For the Quarter beginning on the 1st day of July, and ending on the 30th of September.

No.	When and where Married.	Name and Surname of the Parties.	Condition of Parties.			Rank or Profession.	Age.	Residence.		Parents.	
			If a Widower or Widow, date of decease of former Husband or Wife,	*Children by each former Marriage.* Living	Dead.	*Birthplace.*			Present.	*Usual.*	Names.	Rank or Profession.
	2d February, 1853. St. James' Church, Melbourne. *By License.*	John Green	*Widower (1st June, 1850.)*	3	1	*Liverpool*	Carpenter	32	Collins street, Melbourne	*Kilmore*	William Green, *and Mary Green, deceased, (Maiden name, Jones)*	Carpenter
		Mary Dunn	*Spinster*			*Dedham, Essex*	Dress-maker	28	Bourke Street, Melbourne	*Bourke Street, Melbourne.*	Edward Dunn *Jane Dunn, (Maiden name, Smith)*	Grocer *Schoolmistress*

FORM OF DECLARATION.

WE do hereby declare that we are Members of the Church of England.

Married in St. James' Church, Melbourne, according to the rites and ceremonies of the Church of England, by me,

James Harvey, Officiating Minister.

This Marriage was solemnized between us, } John Green. Mary Dunn.

In the presence of { James Johnson. Sarah Adams.

NOTE.—The names and localities are changed, but otherwise the above is a correct copy.

From what is here seen, it appears to me you will have no difficulty in coming to the conclusion, that in these processes of information, namely, the Government returns of Births, Marriages and Deaths, exist the very best materials for Sanitary and other researches. The next point will be to apply this information in a scientific way; and here we meet the peculiar difficulties of this path of the domain of truth. But, as I said at the commencement, it is not my intention to touch these to-night, but simply to content myself with remarking, that the first step to be taken to arrive at the healthiness or unhealthiness of any particular locality, (as for example, the City of Melbourne) after the establishment of a broad registration system, is carefully to divide that locality into clear, well-defined districts, and to ascertain the relative ages, proportions of the sexes, and occupations of the inhabitants of each district; and I would earnestly recommend the Institute to use all its energies for the determination of these points, which are of capital importance; but once being done, will with the aid of the registration returns leave little to be desired in the way of fundamental operations.

W. H. ARCHER.

IV.

DESCRIPTION OF FIFTY NEW AUSTRALIAN PLANTS, CHIEFLY FROM THE COLONY OF VICTORIA.

BY DR. FERDINAND MUELLER,

GOVERNMENT BOTANIST.

LAID ON THE TABLE, 6TH NOVEMBER, 1854.

The following brief descriptive notes on the botany of this country, have been selected partly from manuscripts elaborated for a Flora of this colony, and partly from unpublished observations on the plants of Australia in general.

In a country, which but a generation ago was an unknown wilderness—the close acquaintance with its productions can be but gradually advanced, and therefore, many a day must yet elapse before a work on its vegetation may be closed, as approaching to that state of perfection which science demands at the present day. It was, however, deemed desirable, that a preliminary account of the lately discovered indigenous plants should be prepared at an earlier period, and the series of them is commenced in the following pages. Still the treatment of so many scientific questions of higher practical importance before this Institute, which favours all branches of science equally, rendered it imperative to draw this paper in as narrow limits as clearness would permit, excluding from it all extensive details, which would more particularly belong to a botanic periodical.

Yet the diagnoses offered on this occasion, although unsupported by ample descriptions, will prove to be sufficient to recognize by them under the requisite literary aid, some of the most characteristic peculiarities of our Flora; and it will be an agreeable duty to the author to continue this series, should it answer the purpose of promoting botanical research here, and diffusing abroad some additional knowledge of the manifold singular productions of our Australian home.

PITTOSPOREÆ.

1. *Billardiera cymosa.*

Branches climbing; leaves lanceolate, flat, acute, entire, above smooth, beneath scantily hairy, on the margin ciliate, at length totally glabrescent; cymes terminal, solitary or paniculate; sepals long-acuminate, somewhat hairy, densely ciliated, at least three times shorter than the corolla; berries cylindrico-oblong, silky or glabrous.

In the Mallee Scrub towards the Murray River, near Guichen Bay; on Spencer's and St. Vincent's Gulf, near Flinder's Ranges; and in Kangaroo Island.

Flowers yellow, or nearly purple or blueish, and in all intermediate shades.

It is a true Billardiera with the inflorescence of a Pronaya.

ZYGOPHYLLEÆ.

2. *Zygophyllum glaucum.*

(Sect. Roepera.)

Herbaceous, ascending or erect, glabrous; leaflets twin, fleshy, glaucous, obliquely ovate, spathulate, perfectly entire, at least three times longer than the margined petiole; peduncle of the fruit drooping, equal in length with the petiole; sepals from a broad base lanceolate, acuminate; capsule

acute-quadrangular, truncate at the top, slightly tapering into the rounded base, its valves net-veined, dimidiate-cordate or oval, wingless.

In the Desert along the Murray, Wimmera and Avoca; on St. Vincent's Gulf, Spencer's Gulf, and in various other places in South Australia.

DIOSMEÆ.

3. *Corræa decumbens.*

Branches decumbent or adscendent; leaves oblong, blunt, above nearly glabrous, beneath clothed with a white or rusty brown toment; flowers solitary; calyx eight-cleft, four of the segments triangular-lanceolate, subulate, the alternating ones twice longer filiform; corolla red, tubulose, with connivent segments; stamens long-exserted; style glabrous; stigma four-cleft.

On the cataracts towards Mount Lofty, and on the banks of the Onkaparinga in South Australia.

A plant not less beautiful than remarkable. The singular form of the calyx will at once offer a mark of distinction from any other of its brilliant congeners.

4. *Phebalium sediflorum.*

Erect; branches scaly and covered with resinous glands; leaves linear, cuneate, truncate or retuse, on the margin from glandular protuberances repand, above smooth, beneath like the terminal generally six-flowered umbels silver-scaly; petals ovate, acute, golden-yellow; filaments not exserted; anthers fixed at the base, with a terminal gland; stigma undivided.

In the Mallee Scrub, at the Murray River, Lake Lalbert, and Lake Tyrrell.

This singular plant exhibits some affinity to Phebalium glandulosum, which, however, is a mountainous species. Its medicinal virtue ought to be tried.

5. *Phebalium podocarpoides.*

Leaves small, crowded, smooth, coriaceous, narrow-oblong, blunt, with entire slightly recurved margin, above even and shining, below silver-scaly; umbels terminal, five to ten-flowered, sessile, as well as the twigs clothed with a scaly, glandular tegument; calyx repand-denticulate, four-times shorter than the ovate-lanceolate petals; the exserted filaments and the style capillary, glabrous; stigma undivided; carpels apiculate; seeds streaked.

On the rocky alpine summit of Mount Buller and the Mitta Mitta Ranges.

6. *Phebalium asteriscophorum.*

Leaves cuneate-oblong, blunt, above covered with dispersed starry hair, beneath as well as branches and pedicels starry-tomentose; umbels generally three-flowered, axillary or terminal; calyx minute; stamens ten, not exserted; anthers fixed at the base, with a very minute gland; germen starry-tomentellous; style filiform; stigma undivided; seeds smooth.

On stony declivities of Mount Disappointment (Dallachi), and on the gravelly banks of the Buffalo Creek.

A beautiful little bush, resembling Asterolasia and Hermannia, and nearest in relation to Hooker's Pheb. grandiflorum from West Australia.

7. *Phebalium ozothamnoides.*

Erect; branches scaly; leaves obovate-cuneate, often retuse, above glabrescent, beneath covered with a starry silvery indument, their margin entire, revolute; umbels terminal, sessile, silver-scaly; petals ovate-lanceolate; carpels trapezoid.

On the gravelly banks of the Mitta Mitta and Livingstone River.

It received its name for some resemblance in habit with Ozothamnus obcordatus.

8. *Phebalium phylicifolium.*

Spreading; twigs somewhat downy; leaves crowded, coriaceous, narrow-oblong, nearly blunt, short-stalked, above glabrous, beneath often white-velvety, with entire recurved margin; umbels axillary, pedunculate, few-flowered; bracteoles bearded; carpels rhombeo-ovate, with a very short beak.

On the highest peaks of the Cobboras Mountains, and on the sources of the Mitta Mitta.

9. *Eriostemon lancifolius.*

Erect, glabrous, glaucous; branches terete, warted; leaves large, coriaceous, lanceolate, acute, flat, entire, sharp-pointed, sessile, densely glandulose; umbels axillary, on a compressed thick peduncle; sepals rounded, slightly ciliated; carpels oblique ovate, compressed, beaked.

On the stony summit of Mount McFarlan, at an elevation of nearly five thousand feet on Mount Tambo and the Upper Mitta Mitta.

10. *Boronia dentigera.*

Branches nearly terete, spreading, hirtellous; leaves thick, glabrous or pubescent, divaricate, trifoliolate; leaflets cuneate-linear, trilobulate at the summit; peduncles axillary, solitary, one to three-flowered, shorter than the leaves, bearing in the middle a pair of leafy bracteas, as well as the subulate-lanceolate sepals slightly hirtellous or pubescent; stamens all fertile with ciliated filaments; seeds asperous.

On sandhills near the La Trobe River, and in McCrae's Island. Also, near the Pendland Hills, according to Mr. Dallachi.

MYRTACEÆ.

11. *Eucalyptus cosmophylla.*

Shrubby; leaves alternate, thick—coriaceous, opaque, glaucescent, ovate- or falcate-lanceolate, cuspidate-acuminate,

thinly veined, destitute of pellucid dots; peduncles short, axillary, angulate, with one—three large flowers on thick pedicels; lid hemispherico-depressed, mutic or umbonate, or conically pointed; tube of the calyx obconico-bell-shaped, with two indistinct ribs, a little longer than the lid; fruits half-ovate, not contracted at the orifice; valves of the capsule nearly inclosed.

On stony places in the Lofty and Bugle Ranges.

One of the handsomest species of this extensive genus.

12. *Eucalyptus costata.*

(Behr & Muell. Coll.)

Shrubby; leaves alternate, rigid, coriaceous, shining, ovate or narrow-lanceolate, uncinate-acuminate, thinly veined, with scanty pellucid dots; umbels axillary, on a valid compressed peduncle; flowers large with a short and thick pedicel; lid from a hemispherical base contracted into a narrow cone, with radiating ribs; tube of the calyx campanulate, slightly constricted in the middle, generally twelve-ribbed, a little longer than the lid; fruits large, nearly bell-shaped, with scarcely contracted orifice; valves of the capsule inclosed; seeds blackish without streaks.

In the Mallee Scrub, from the Murray River to Spencer's Gulf.

The nearest alliance of this species appears to with E. cuspidata.

13. *Eucalyptus Leucoxylon.*

Arboreous; leaves alternate, somewhat shining, narrow-lanceolate, subfalcate, tapering into a long uncinate acumen, veined and furnished with pellucid dots, umbels axillary, generally three-flowered, with a thin peduncle; lid conico-hemispherical, acuminate; tube of the calyx semiovate, somewhat longer than the lid; fruits semiovate, hardly contracted at the orifice; valves of the capsule inclosed; seeds blackish clathrate.

In grassy plains from the Avoca to St. Vincent's and Spencer's Gulf.

This is the "White Gum Tree" of the South Australian Colonists.

14. *Eucalyptus fasciculosa.*

Arborescent; leaves alternate, opaque, glaucescent, elongate-lanceolate, curved, gradually tapering into an uncinate acumen, thinly veined, destitute of pellucid dots; umbels paniculate, few-flowered; nearly hemispherical, minutely apiculate, thin and smooth: tube of the calyx clavate, obconical, angular, glandulose, contracted at the top, gradually tapering into a short pedicel, three times longer than the lid; fruits obconico-campanulate, slightly contracted at the orifice; valves of the capsule inclosed, seeds clathrate.

On barren ridges along St. Vincent's Gulf, on the Gawler River, in the Mount Lofty Ranges and Bugle Ranges, and on Encounter Bay.

15. *Eucalyptus largiflorens.*

Arboreous; leaves alternate, glaucous, opaque, oblong-lanceolate, acute, slightly oblique, thinly veined, hardly dotted; umbels pedunculate, panicled, few-flowered; flowers small, on short pedicels; lid double, thin, nearly even, hemispherical, blunt, or minutely apiculate; tube of the calyx obconical-bell-shaped, hardly angular, twice as long as the lower lid; fruits small, half-ovate, short-stalked, slightly contracted at the top; valves of the capsule inclosed.

In bushy, barren localities on the Murray, Avoca, Wimmera, and on St. Vincent's Gulf.

A small tree, with persistent grey-blackish bark.

16. *Eucalyptus Behriana.*

Fruticose; leaves alternate, coriaceous, somewhat shining, lanceolate or ovate, acute, slightly oblique, thinly veined,

dotted; umbels pedunculate, panicled, few—flowered; flowers small, nearly sessile; lid hemispherical, blunt or minutely apiculate; tube of the calyx obconical, bell-shaped, nearly twice as long as the lid; fruit half-ovate, sessile, not contracted at the top; valves of the capsule inclosed; seeds brown, streaked.

In arid plains and on stony bare hills near the Avoca, Murray, Gawler River, and in Bacchus Marsh.

17. *Eucalyptus santalifolia.*

Fruticose; leaves alternate, coriaceous, glaucescent, opaque, oblong-lanceolate, hooked-acuminate, a little oblique, thinly veined, hardly dotted; umbels axillary and terminal, pedunculate, capitate; lid depressed-conical or hemispherical; tube of the calyx obconical, bell-shaped, nearly three times longer than the lid; fruit not contracted at the top; valves of the capsule enclosed.

In the Mallee scrub on the Murray River, on St. Vincent's and Spencer's Gulfs.

18. *Eucalyptus gracilis.*

Fruticose; leaves coriaceous, alternate, shining, narrow-lanceolate, hooked-acuminate, a little oblique, thinly veined, dotted; umbels axillary and terminal pedunculate; flowers small, short stalked; lid blunt, depressed-hemispherical; tube of the calyx obconical, bell-shaped, a little broader and three times longer than the lid; fruit nearly hemispherical, not contracted at the top; valves of the capsule almost inclosed.

In the desert on the Murray River, where it forms the Mallee Scrub together with E. dumosa, santalifolia and other species.

LEGUMINOSÆ.

19. *Sesbania Australis.*

Herbaceous, erect, unarmed; leaves with from twenty to thirty pairs of oblong blunt mucronulate leaflets, which are opaque, above smooth, beneath with the branches at first slightly hairy; racemes with five to ten flowers erect; peduncles shorter than the leaves; coralla smooth, twice or three times longer than the calyx; standard variegated with black streaks and dots; pods terete-compressed, acuminate-pungent, slightly falcate, subtorulose, as long as the angular, somewhat hairy rachis of the leaves.

On the Darling River.

The only notice of the existence of Sesbania in this part of the globe, is given in Sir Thomas Mitchell's Tropic. Australia, p. 109, where a species allied to the East Indian Sesbania aculeata is mentioned as found on the Narran. From this remark I am led to suppose, that the plant in question differs from ours, which stands in much nearer relationship to Sesbania picta from New Spain.

COMPOSITÆ.

20. *Eurybia conocephala.*

(Sect. Aglossa.)

Leaves small, obovate, cuneate, or spathulate, sessile, on both sides as well as the branchlets from a thin grey toment velutinous, with flat entire margin; flower-heads axillary and terminal, solitary, subsessile; involucre at first oblong-cylindrical, at length obconical; scales imbricate, in several rows, rounded-blunt, towards the upper end tomentellous, on the margin ciliate, outer ones ovate, interior ones oblong; flowers all tubulose, hermaphrodite, with erect teeth of the corolla; achenes cylindrical, subangulate, glabrous; pappus biseriate, its bristles hairy, scabrous, the outer ones but little shorter.

In the desert on the Murray River, near Morunde.

A most remarkable plant, in habit not dissimilar to *E. pimeloides*, but in its characters widely distinct.

Pleuropappus.

A new genus of Angiantheæ.

Capitulum with two flowers, numerous, homogamous, densely aggregated into a cylindrical glomerulus. General involucre shorter than the glomerulus, pluriseriate; its outer scales leafy, linear, unequal; interior ones paleaceous, without an appendage. General receptacle simple, filiform, paleate; partial ones very short. Special involucre of the flower-head consisting of four scarious exappendiculate scales, furnished besides with three subovate bracts. Exterior scales two, sessile, folded together, with a dilated base; interior ones two, orbicular-ovate, stalked. Flowers, hermaphrodite. Corolla three to five-toothed, cylindrical, with an attenuate base. Divisions of the style at the extremity convex, dilated slightly bearded. Anthers at the base hastate. Achenes glabrous, obovate. Pappus arising out of a gland from the side of the achene, cymbiform, scarious, deciduous, fimbriate, sometimes producing one or two very short bristles or a small lamina.

A genus as well allied to Angianthus, as to Phyllocalymma, of both, however, exquisitely distinct by the form and quite abnormal position of the pappus.

21. *Pleuropappus phyllocalymmeus.*

On sterile plains of the Port Lincoln district.—*C. Wilhelmi.*

An annual erect branched glabrescent herb, with alternate linear leaves and terminal, solitary, golden-yellow glomerules.

22. *Ixiolæna supina.*

Viscid-pubescent; stem procurrent, adscendent; leaves somewhat fleshy, lanceolate, blunt, tapering into a half-clasp-

ing base, on the margin somewhat revolute; scales of the hemispherical involucre appressed, linear-lanceolate, viscid, downy on the back, the interior ones terminated in a scarious lanceolate-ovate, smooth, appendix; achenes sulcate, cylindrical, glabrous, somewhat shining; bristles of the pappus about twenty.

Amongst rocks on the south coast of Kangaroo Island.

23. *Helichrysum adenophorum.*

Shrubby; branches and leaves glandulosely asperous; leaves linear, revolute, clasping with broader base; flower-heads solitary, terminal; scales of the involucre white, the exterior ones lanceolate, on the back and margin slightly downy, interior ones oblong-lanceolate, woolly on the apex of the glandulous semiterete stipes; achenes glabrous, subcylindrical, at the base attenuate, three times shorter than the pappus, which is serrate, and at the top dilated.

On barren elevations of Kangaroo Island.

24. *Helipterum præcox.*

(Sect. Leucochrysum.)

Stems annual; slightly woolly-pubescent, erect, simple, nearly to the top foliate; leaves glabrescent, narrow—linear, sessile, mucronulate, the uppermost scariose; receptacle short—conical, glabrous, scrobiculate; interior scales of the involucre white, lanceolate, acute, their stipes woolly at the apex; exterior scales subhyaline, gradually narrowed into a long acumen; achenes ovate, quite glabrous, rugulose; bristles of the pappus five to eight, yellowish-white, connate at the base, thence long-plumose.

Abundant on the less fertile plains and low ridges along the Avoca, Avon, Wimmera, and Richardson River.

25. *Helipterum exiguum.*

(Sect. Leiochrysum.)—H. diffusum Sond. in Linnaea xxv., p. 518. *not Candolle.*

Very dwarf, annual, slightly hairy; stems branched, foliate up to the top; leaves sessile, linear, mucronulate, the uppermost surrounding the solitary terminal flower-heads; receptacle glabrous, nearly flat, scrobiculate; interior scales of the involucre scarious, oval-oblong blunt, glabrous, flavescent, not spreading; exterior scales acutish, brown-red or greenish; achens perfectly glabrous, dotted; bristles of the pappus nine to eleven, white, long-plumose.

In sandy stony declivities of the Grampians, the Serra and Victoria Ranges, near Gawlertown, and in the Bugle Ranges.

This pygmy of the genus, will be distinguished by exceedingly dwarf, branched and somewhat hairy stems; by heterogamous flower-heads, and perfectly glabrous fruits from that plant which De Candolle named diffusum.

26. *Senecio helichrysoides.*

Suffruticose, simple, white—tomentose; inferior leaves long-lanceolate, superior ones, sessile, linear-lanceolate, all acute, with entire revolute margin; cymes few-headed; involucre bell-shaped-cylindrical, about twice as long as the linear bracts, scales generally thirteen, on the back woolly-tomentose, tapering into a smooth reflexed acumen; flowers all tubulose, hardly exserted; achenes glabrous.

On low sandy loamy hills near the Wheal Barton mine.

LOBELIACEÆ.

27. *Laurentia platycalyx.*

Glabrous, creeping; leaves fleshy, oblong, or obovate-lanceolate, entire; peduncles axillary, one-flowered, generally of less than half the length of the leaves; calyx compressed, ovate, five-toothed; tube of the corolla very short; its laciniæ nearly equal; faux glabrous.

In moist subsaline meadows from Port Phillip away to the westward.

This singular plant possesses scarcely the acridity and the milky juice, so universal in this order.

GOODENIACEÆ.

28. *Goodenia glauca.*

Erect, simple, smooth; axils bearded; leaves glaucous, lanceolate, acute, radical ones broader, all entire, gradually tapering into the base; peduncles one-flowered, axillary and terminal, solitary or twin, without bracteoles, longer than the upper leaves, at all times erect; segments of the calyx linear-subulate; corolla pale yellow; style villosely downy.

On the banks of the Murray and Avoca.

Allied to G. elongata.

EPACRIDEÆ.

29. *Acrotriche prostrata.*

Branches weak, prostrate, pubescent; leaves crowded, divaricate, narrow-lanceolate, mucronate, very slightly on the ciliate margin recurved, beneath a little paler, nerved and glabrous, above scantily downy; spikes forming a corymbose head, growing out of the branches below the leaves; sepals half as long as the tube of the greenish corolla, oblong-ovate, pale, membranaceous, hairy on the summit.

On wooded low ridges from the Dandenong range to the Delatite river.

The nearest affinity is to A ramiflora, and it produces likewise eatable fruits.

MYOPORINÆ.

Duttonia, a new genus.

Calyx deeply five-cleft, persistent, with spreading linear-subulate segments. Corolla inside densely bearded; its tube

short, cylindrical; faux ampliate; limb bilabiate; upper lip with two acute teeth, lower one tripartite. Stamens didynamous inclosed; the two longer filaments inserted near the base of the corolla, the two others very short affixed to the faux. Anthers divaricate. Style simple, glabrous, longer than the stamens. Stigma minute, undivided. Capsule oblong, slightly compressed, quite blunt, as long as the calyx, with two incompletely bilocellate cells. Seeds in the locell's solitary, linear.

30. *Duttonia gibbifolia.*

On stony ranges at the Mount Barker Creek in South Australia.—*Fischer.*

A shrub almost with the habit and leaves of Eriostemon gracilis. Leaves alternate, appressed, deciduous, beneath convex and gibbous from two small tubercules. Flowers axillary sessile solitary.

SANTALACEÆ.

31. *Leptomeria pungens.*

(Sect. Oxymeria.)

Branches and twigs terete, spinescent; leaves deciduous, narrow-lanceolate, somewhat channelled; bracteoles deciduous, navicular-rhomboid, acuminate, crenulate; flowers spicate, five-cleft; stigma five-rayed.

In the Mallee scrub along the Murray River, St. Vincent's and Spencer's Gulf, not rare.

Allied to L. Lehmanni. The fruit of a pleasant taste, not unlike acidulous grapes.

32. *Santalum persicarium.*

(Sect. Fusanus.)

Arborescent; leaves coriaceous, narrow-lanceolate, terminating into a short hook, glaucous, without veins; panicles

brachiate; bracteoles at length drooping, linear-subulate, recurved, of the length of the flowers; base of the filaments with fasiculated hair; drupe globose, dry, slightly rimose and foraminous.

In the Mallee scrub on the Murray river, Spencer's and St. Vincent's Gulf.

It differs from Santalum Preissianum in the evidently narrower and more glaucous leaves, in longer pedicels, in less deciduous narrower and longer bracteoles, in the bitter juiceless brownish pericarp, and in the larger putamen, with much less deep fissures and pores. The toasted bark from the root is used as food by the natives, and the infusion of it as tea.

33. *Exocarpus pendula.*

Arboreous; branches pendulous; leaves deciduous, linear-subulate, recurved at the summit; spikes long-pyramidate, stalked; their rachis puberulous; bracteoles nearly triangular as well as the five-parted calyx glabrous; pedicels rose-red; drupes indistinctly streaked, ovate-globose.

In the Mallee scrub on the Murray river, on Spencer's and St. Vincent's Gulf.

XEROTIDEÆ.

34. *Xerotes dura.*

Scape very short; leaves rigid, opaque, long-linear, beneath convex, teethless at the apex, their margin scabrous, but at length smooth; flowers of both sexes in glomerate sessile whorls; clusters in a verticillate branched panicle; capsule even.

On barren localities, as well of the mountains as plains in South Australia.

GRAMINEÆ.

35. *Agrostis gelida.*

Erect, densely tufted, glabrous; leaves complicate-setacous, radical ones generally of equal length with the stem; panicle closely contracted; bracteas navicular-lanceolate, acuminated, smooth, along the keel somewhat scabrous; lower one but little longer than the other, but considerably exceeding the flower; sepals awnless, glabrous, very thin, 5-nerved, erosely blunt, the lower one a little shorter.

On the top of the Cobboras mountains.

An alpine grass in some relation to Agr. Falklandica.

36. *Agrostis nivalis.*

Erect, densely tufted; leaves flat, short, broad, above scabrous, otherwise with stems and vaginæ smooth; panicle contracted, with imbricate branches; calyx very short-stalked, bearded at the base; bracteas somewhat acuminated, nearly equal to each other, glabrous, rough along the keel, as long as the calyx; exterior sepal smooth, 5-nerved; awn from below the summit, half as long as the sepal.

On the grassy top of Mount Buller.

37. *Stipa aristiglumis.*

Stems terete as well as its knots and sheaths glabrous and nearly even; leaves long, convolute, a little scabrous; ligule short, without fringes; panicle elongate, spreading, with fasciculate branches; awns scabrous, otherwise naked, flexuous, slightly bent in the middle, four or five times longer than the silky flower; bracteas green, glabrous, navicular-lanceolate, bristle-like-acuminated, ribbed; 3 of the ribs generally terminating in short awns; the upper bractea a

little shorter than the other and not much exceeding the length of the flower.

In bushy parts of the Murray Desert.

Allied to Stipa læviculmis.

38. *Aristida contorta.*

(Sect. Arthratherum.)

Stems erect, hardly branched; panicle racemose, contort; bracteas coloured, long tapering into a setaceous apex, the exterior one half as long as the other, equal in length to the calyx; inferior part of the arista closely twisted, half as long as the scabrous bristles, surpassing twice in length the calyx

On barren places on the Murray River.

Allied to Aristida stipoides.

39. *Aristida Behriana.*

(Sect. Chaetaria.)

Stems spreading, simple; panicle branched, condensed; bracteas tapering into a setaceous apex; the exterior one half as long as the other, reaching to the partition of the arista; bristles of the latter scabrous.

In dry loamy places near Port Adelaide, at the Barossa Ranges, the Murray River, and elsewhere in South Australia.

This grass approaches in its characters to Aristida calycina.

40. *Danthonia robusta.*

Stem high, robust; leaves flat, glabrous, short-bearded at the base; panicle contracted, lanceolate; spikelets generally four-flowered, shorter than the somewhat scabrous bracteas, exterior sepal villose to the middle; the upper series of hair touching the fissure; lateral divisions of the sepal tender membranaceous, half as long as the awn.

On stony declivities, in the higher parts of Mount Buller.

41. *Poa syrtica.*

Root fibrous, annual; leaves involute, setaceous, as well as ligules and sheathes glabrous; panicle strict, contracted; spikelets nearly sessile, seven to twelve flowered, oblong-linear; calyces blunt, densely imbricated; inferior sepal convex, five-nerved, glabrous.

Sandy shores of Spencer's and St. Vincent's Gulf.

42. *Poa ramigera.*

Stems long, diffuse, below distinctly branched; leaves glaucous, involute, setaceous, with the vaginæ and joints glabrous; ligule very short, ciliolate; panicle spreading, with solitary branches; spikelets lanceolate-linear, five to seven flowered; inferior sepal laxe, membranaceous, blunt, indistinctly three-nerved, as the upper one glabrous.

A robust grass, abundant in boggy places, subject to inundations, on the Murray River.

43. *Poa brizochloa.*

Leaves nearly flat, as well as the vaginæ glabrous, but often rough; joints even; ligule long, torn; panicle effuse; its branches single or twin, capillary; spikelets ovate, at length roundish; five-eight-flowered; inferior sepal five-nerved, erosely blunt, on the margin and on the back below the middle ciliate; upper sepal naked, short-bi-lobed.

On sandhills on the Murray River, Crystal Brook, Rocky River, Tanunda, and other places in South Australia.

44. *Panicum coenicolum.*

Stems erect; leaves flat, with their sheaths downy; ligule short, torn; branches of the panicle with remote flowers, at last spreading, the lower ones whorled, the upper ones solitary or twin; rachis somewhat scabrous, bearded at the axils; spikelets narrow-lanceolate, awnless, often solitary,

imperfectly silky-villose; exterior bractea ovate-lanceolate, blunt, glabrous, much shorter than the seven-nine-nerved interior one.

In places subject to inundations; towards Morunde, and near Cudnaka.

Similar to the following species, but the flowers nearly twice as large, and less downy.

45. *Panicum ammophilum.*

Stems spreading; leaves flat, short, with the joints of the stem velvet-downy; upper sheaths glabrous; branches of the panicle with remote flowers, at last spreading, the lower ones whorled, the upper solitary or twin; rachis somewhat scabrous, bearded at the axils; spikelets lanceolate, awnless, silky-villose, single or geminate; exterior bractea minute, lax, ovate—lanceolate, nearly blunt, glabrous, much shorter than the other.

On sandhills along the Murray River.

46. *Panicum convallium.*

Leaves below flat, as well as their sheaths hairy, rarely glabrous; joints of the stem villose; ligule very short, ciliate; panicle wide, perfectly expanded, with hardly flexuous fasciculate somewhat scabrous divided branches; axils short-bearded; spikelets solitary, shorter than the peduncle, glabrous, ovate-lanceolate, acute, awnless; exterior bractea trinerved, nearly heart-shaped, short pointed, half as long as the interior 5-nerved one.

On the banks of the Torrens and Gawler River, on the Murray River and along the Flinders Ranges.

47. *Panicum prolutum.*

Leaves flat, glaucous, as well as the joints and the sheaths smooth; ligule long, ciliate, torn; panicle wide, spreading,

with fasciculate, scabrous, hardly flexuous, divided branches; spikelets solitary, shorter than the peduncle, glabrous, ovate-lanceolate, acuminate, awnless; exterior bractea oblong-lanceolate, nearly blunt, tri-nerved, membranaceous on the margin, more than half as long as the interior one, which is seven-nerved.

On the Avoca, Broughton, and Leight river, as also at the foot of the Flinders ranges, in localities subject to inundations.

The flowers are almost twice as large as in P. convallium, to which this species bears much affinity.

48. *Panicum melananthum.*

Leaves broad, quite flat, as well as the joint of the stem smooth; sheaths and the very short ligules ciliate; panicle effuse, with capillary divided, somewhat scabrous, flexuous branches; spikelets glabrous, almost shorter than their peduncle, ovate-lanceolate, acute, awnless; exterior bractea ovate, somewhat acute, tri-nerved, hardly half as long as the interior one, which is five-nerved.

On wet, sandy, or gravelly banks of the Ovens and King River.

49. *Panicum lacunarium.*

Leaves flat, as well as the joints, and the sheaths smooth; ligule wanting; spikes appressed, mostly simple, the lower ones remote; rachis smooth; spikelets large, ovate, long-acuminate; exterior bractea round, trinerved, pointed, on the margin membranaceous, more than half as long as the interior one, which is five-nerved; nerves of the bracteas and of the sterile flower scabrous.

Around the Murray lagoons.

50. *Hierochloe submutica.*

Root creeping; stem together with its knots even; leaves flat, short, broad, linear, with their sheath somewhat scabrous; branches of the panicle spreading, the lower ones hardly drooping; pedicels somewhat hairy; bracteas with a nerve on both sides towards the base, lower one shorter than the flowers, the upper one a little broader and of the length of the calyx, their keel at last smooth; flowers indistinctly five to seven-nerved, all awnless or rarely the upper male one with a very short arista below the apex; margin of the female flower smooth, their back at the summit bearded; margin of the male flowers ciliated.

On the summits of the Cobboras mountains, at an elevation of 6,000 ft.

This elegant and nutritious grass luxuriated on the limits of eternal snow, like other Hierochloas of the arctic and alpine regions.

Its nearest affinity is with Hier. fragrans from North America.

V.

ON THE DETERIORATION OF GRAIN AND FLOUR.

BY JOHN MAUND, M.D.

READ 27TH NOVEMBER, 1854.

It has occurred to me, Mr. President and Gentlemen, that an enumeration of the chemical changes, and the best means of preventing such, that often take place in grain and their products, flour, meal, &c., during their transmission from

other countries to this colony, would not form an inappropriate subject for a paper, even at this early period of the existence of our Society; for though our main wish may be to develop and unraval the resources of Australia, still we must provide for the interval that occurs before this can be, or at least is accomplished.

And having, Sir, premised your concurrence in the above opinion, I shall offer no further apology for bringing forward the present subject for the consideration of the Society.

Though the subject admits, from its general connexion with the process known as fermentation, of entering into perhaps the most interesting and abstruse departments of practical and theoretical chemistry, I shall on the present occasion notice, but very cursorily, the changes called fermentation, on which mostly depends the alterations which take place in grain, flour, &c., when they become what is termed sour, unsound, or musty, on which changes, I have well ascertained, depends much of the unwholesomeness of food sold as bread, &c., to the Melbourne population.

As flour undergoes much the same change, and indeed more easily so, than unground grain does, I shall adopt this as a type of the whole.

During the last two years I have examined upwards of a hundred samples of what is termed by the merchants and bakers unsound flour; and certainly, the term is most appropriate when it is considered as the main staff of life.

It has appeared to me that different samples present two distinct states, though the one is probably only an advanced stage of the other.

First. That in which free acid is present, and is commercially known as sour flour.

Second. That in which no acid in a *free state* exists, but from which the volatile alkali, ammonia, can generally be eliminated and is known as musty flour.

The first change, where free acid exists, is much the most

common, and as a knowledge of its cause of production and the means of preventing its taking place are to the public most important, and, in addition, may be clearly explained, I shall relate these before referring to the chemical and atomic alterations which actually take place in the flour.

The cause then of good grain and flour becoming sour, during its transmission from other countries to this, is due to nothing more than fermentation: which is produced by the presence of moisture alone, but this is much facilitated by a high temperature and the presence of atmospheric air.

All grain or flour naturally contains water, the quantity of which varies according to their age &c. The amount of water contained in good wheat flour, varies from about six to sixteen per cent., though I have often found it to exist in a much larger proportion. The increase of which may be due to accidental or intentional causes.

Thus, the miller occasionally wets his wheat to assist the more perfect separation of the flour from the bran. Absorption of moisture may also occur from being in a damp atmosphere before it is packed, or by directly coming in contact with water before its voyage, or after its arrival here.

The main cause then of this change being appreciated, its remedy is very simple, and has long been more or less followed; this consists in using artificial heat, by the means of steam, hot air, &c., so as to expel the greater portion of the moisture. Great heat is not required to effect this, it should be moderate and prolonged, so as not to injure any of the qualities of the grain or flour. This precaution is frequently neglected, for I have often met with oats here considerably damaged by excess of heat being applied in the process often adopted before shipping, termed kiln drying. Though great heat is not required to prevent fermentation, that of the temperature of boiling water is often required to arrest it when commenced, and indeed such an opponent is this temperature to fermentation, that it will at once arrest it, even when going on in its most active form.

The theories regarding the fermentive process by which the acid state takes place are too numerous and complex to enter minutely into. Evidently it requires for its production a substance containing nitrogen, which by its contact, under favourable circumstances, with a substance containing oxygen, as do air and water, the equilibrium of the attractive forces which hold the organic atoms together is disturbed; a re-arrangement of the elements of the compound being produced, and the consequent formation of new products, for after fermentation has taken place a totally different substance is produced, while in some instances the chemical composition remains precisely the same. Take for instance, the sugar contained in milk, which is composed of carbon 12 atoms, hydrogen 12, and oxygen 12; by fermentation it is changed into lactic acid; (carbon 6, hydrogen 6, oxygen 6), two atoms of which correspond exactly in composition to one of the sugar. This seems to demonstrate that the change of properties depends solely on a change in the position of the atoms of the sugar of milk, they being merely re-arranged in a new order in the lactic acid.

In other cases gases, such as carbonic acid and hydrogen are given off, and it is easy to comprehend and calculate the change which takes place.

In plants starch, gum, sugar, &c., are often, Liebeg says, formed from organic acids, and doubtless a somewhat similar though opposite change occurs where these higher compounds are reduced to more simple ones, but in the present instance, if we look to the composition of cane sugar, (such as exists in wheat), which is composed of carbon 12, hydrogen 11, oxygen 11, we see it merely requires one atom of water, that is, one atom each of oxygen and hydrogen to make a compound of the same chemical composition as two atoms of lactic acid, which is the one mostly present in sour grain.

If instead we take starch or gum, (carbon 12, hydrogen 10, oxygen 10,) which enters largely into the

composition of wheat, but is less easily acted on than sugar, we have only to add two atoms of water to their composition, when we shall have the proper proportions to make lactic acid.

If the acid present be acetic acid, the change in composition is as easily made, for it merely requires two atoms of water in addition to one atom of starch, to produce three of vinegar or acetic acid.

The second state I referred to, where free acid is not present, but frequently exists in combination with ammonia, is generally found in the flour which is termed musty, and this, is often, in addition mouldy. This state, I believe, is merely a more advanced stage of the former or acid one, by two subsequent changes occurring, viz.:—first, the acid state is produced by fermentation, which is induced by moisture, as previously described; this acid when formed re-acts on another portion, the glutinous part of the grain, causing it to decompose; its nitrogen being set free unites with the hydrogen, forming ammonia, this being an alkali combines at once with the free acid forming a neutral compound from which the ammonia is easily eliminated by boiling with caustic or quick lime.

Thus, I regard this musty condition of flour as a state further advanced in decomposition, being an early stage of putrefaction, which if it continued to proceed would end in the carbon being converted into carbonic acid and the hydrogen into water.

If amongst our members present, there are any who have devoted attention to this change which takes place in flour I shall be most glad of their opinion on the matter, as I have not been able to find the subject referred to in any authorities I have consulted.

But in proof of the supposition being a correct one, I may mention that in musty flour where this state existed, I invariably found the glutin proportionably as the flour was bad

reduced in quantity, and that the portion remaining always deteriorated in quality.

In conclusion, Sir, I would wish just to refer to some of the disadvantages which accrue to the public from flour in the states referred to being employed, as it often is, in making bread; and to be more laconic I arrange them under different heads.

First. The bread is not so palatable, particularly if kept a day or two.

Second. It is less nutritious from the reduction in the amount of the glutin or staminal principle.

Third. It is injurious to health from being in a state approaching putrefaction, and also from alum being almost necessarily employed to convert it into saleable bread.

Fourth. It is a means of introducing dishonesty into legitimate trade; first, with the merchant miller, who has to mix bad with good flour to make it even saleable to the baker; and secondly, with the baker who is frequently obliged to use alum or some equivalent substance with this flour to convert it into bread of as good appearance and taste as will satisfy his customers.

VI.

ON WATER SUPPLY TO THE CITY OF MELBOURNE.

BY M. B. JACKSON, C.E.

READ DECEMBER 23, 1854.

THE extraordinary and almost unprecedented rapidity of the growth and extension of the city of Melbourne, which, within a period of about twenty years from its foundation, has attained a population of nearly 100,000, coupled with the fact, that the entire supply of fresh water to the inhabitants has, until lately, been derived either from the winter rains or drawn from the river to the houses of the inhabitants, at an almost fabulous expense, in water carts, may create some surprise in the minds of reflecting individuals that steps have not been taken until a recent period to provide a permanent and sufficient supply to the city, on the constant and high service principle.

The first document extant, which shows that the subject had engaged the attention of any public body, is a report of the late City Surveyor, James Blackburn, Esq., to a Committee of the City Council, dated January 8th, 1851. This report, along with several others, were submitted by that gentleman to the City Council, and in the whole of them the writer evinced a considerable amount of practical knowledge of the subject on which he treated. Previous to this date, however, it appears from the City Surveyor's report a suggestion had been made by Mr. King, formerly Town Clerk

of Melbourne, that a supply for the city might be obtained by erecting water-wheels near Dight's mill, and constructing reservoirs on the high ground, near the residence of John Hodgson, Esq., M.L.C.

Towards the close of the year 1852 a Select Committee of the Legislative Council was appointed, to inquire into the subject, and to consider and report on the various schemes that had up to that time been proposed for supplying the city.

These schemes appear to have been five in number. 1st. That of Mr. King, which consisted in driving a tunnel through the isthmus, near Dight's mill, so as to render available a fall of the river, of from twelve to thirteen feet, for the purpose of driving one or two water-wheels.

2nd. That of Mr. Blackburn, which proposed to draw the supply of water from several creeks and springs which flow from Mount Disappointment, and which when united form the River Plenty.

3rd. Mr. King's scheme, as modified by Mr. Blackburn—the modification consisting in a suggestion to erect a steam-engine, as an auxiliary to the water-wheels.

4th. Mr. Hodgkinson's scheme, which was to raise the entire supply by steam-power into reservoirs, situated on the high ground near Dight's mill, on the south side of the river, the reservoir to be situated about 1,500 feet from the proposed engines.

5th. Mr. Blackburn's gravitation scheme, as modified by Mr. Oldham—the modification consisting chiefly in recommending that pipes should be substituted for an open cut, as the means of conveying the water from the Plenty to Melbourne.

The result of the deliberations of the Select Committee was, that a Commission, consisting of four gentlemen, (non professional,) was appointed, to enter into the subject closely, and afterwards to cause to be carried out that scheme, "not

limiting the choice to those already proposed," which should, after due deliberation, appear to them to be the best.

On the 20th of June, 1853, I had the honor of being appointed Engineer to this Commission, and I received directions to examine and report on the different schemes that had then been proposed for supplying the city from the Yarra.

The first of these schemes, that of Mr. King, I condemned at once, inasmuch as I found that the fall was insufficient; that the whole quantity of water passing down the river in a season of great drought would not be enough to work wheels of the power required; and that they would be inoperative during floods, the water having been known to rise upwards of twenty feet. A suggestion made by the late James Blackburn, Esq., to erect a steam-engine as an auxiliary, I also deemed it inexpedient to adopt.

The next scheme to which my notice was directed was one known as Mr. Hodgkinson's, which was to erect two steam-engines on the banks of the Yarra, opposite the Yarra Bend Lunatic Asylum, and to construct reservoirs on the high ground, in the rear of the residence of John Hodgson, Esq., M.L.C.

To this scheme also I considered that there were many weighty objections, the chief of which were the great difficulty, "not to say impossibility, of conveying to the proposed site for the engines the machinery required," the enormous cost of constructing the reservoirs which would have required to be excavated out of a bed of bastard freestone, not calculated to hold water, and the great expense of executing repairs and providing fuel.

These were the schemes that had been proposed for supplying the city from the Yarra; and, although I was well aware that it was quite possible to devise a pumping scheme, in which most of the difficulties above stated would have been obviated, I considered it my duty to recommend that

the country round Melbourne should be well and thoroughly explored, to ascertain all the facilities that existed for supplying the city by gravitation.

Having thus come to the conclusion that the natural method of gravitation was the only plan to be pursued, I turned my attention to the river Yarra, to ascertain if it were not practicable to derive a supply from it; but so precipitous are its banks that I found it impossible to dam it back or lead in a pipe in a shorter distance than upwards of thirty-five miles from Melbourne.

I next examined the Diamond, Darebin, and Merri Creeks, (vide plan,) and the Plenty River and I found that the Merri Creek took its rise from a large swamp, covering about 1,200 acres of ground: that this swamp received the drainage of above thirty square miles, and that the water was discharged from the swamp into the Creek by a narrow outlet. This I considered a very eligible site for the construction of a store reservoir, as a very short embankment would convert the swamp into a large artificial lake; but on measuring the distance from town I ascertained that it exceeded thirty miles.

It is an indisputable fact, however, that the converting of this swamp, "and also many others," into large store reservoirs, to be used to irrigate the country during the dry weather, would be a great public benefit; that by these means the country might be converted into a great grain-producing district, exceeded by none in the world; and that until such measures are adopted it will be comparatively sterile.

I am also of opinion that such artificial lakes would have a great and beneficial effect on the hot winds of the colony, and undoubtedly bush fires would no longer occur in the districts commanded by such reservoirs.

Having thoroughly explored the country for a distance of thirty miles round Melbourne, and ascertained that neither

the Diamond nor Darebin Creeks presented greater facilities than the Merri, I examined the Plenty River, and found that the scheme suggested by the late James Blackburn, Esq., was, with some modifications, the best that could be devised. This plan was to convert into a large store reservoir a swamp known as Rider's Swamp, situated on the east bank of the Plenty, and about twenty miles from town, and to lead the water by an open aqueduct into two distributing reservoirs, to be constructed near the Cemetery.

The necessity of constructing a store reservoir would not be manifest to a casual observer; but as it would appear from the evidence of those settlers who have been established on the banks of the River Plenty for the longest period of time, that at a ford known as the Bridge Inn Ford, the Plenty has been known, on several occasions, to cease to flow, the necessity becomes more obvious. I therefore adopted the site proposed by Mr. Blackburn for a store reservoir; which, for its natural fitness for the construction of a reservoir is not to be surpassed; and proceeded to mature the plan for supplying the city.

In the first place, I found that the store reservoir would receive the drainage of upwards of nine square miles.* By the first plan made under my direction for supplying the reservoir, the drainage into the reservoir, independent of the River Plenty, would have been upwards of eighteen square miles† —an area which, in my belief, is sufficient of itself to afford an ample supply of water for the city, without looking to any other source; but as droughts of two or three years standing have been known to occur, I considered that it would be advisable to lead in the Plenty River.

Mr. Blackburn originally proposed to lead in the river, over the end of the embankment. In my plans the river is

* The real drainage area of the reservoir basin is 5950 acres, including the area of the reservoir itself.

† This plan was afterwards altered, and a cheaper substituted.

caused to enter at the west side of the reservoir, and to pass out over a bye-wash at the south end.

By these means circulation will be promoted through the reservoir. To lead the water into the reservoir, however, it is necessary to drive a drift, 420 yards in length, through the saddle of the range.

Into the valley of the Plenty, it is perhaps necessary to remark, that the water from the Merri Creek, the King Parrot Creek, one of the tributaries of the Goulburn river, and the Running Creek, could be led; and thus a supply for almost any amount of population could be obtained.

In passing from the store reservoir, the surface of the water in which will be 595 feet above the sea, the water for the supply of the city will be discharged through three pipes, passing through the embankment; and immediately within the embankment a tower well, with discharging valves, &c., has been erected.

The method adopted for discharging the water through the well, with the valves, &c., I believe to be entirely original, and one which has never before been adopted.

From the outside of the embankment one line only of the pipes is at present intended to be laid—this line will be led down to a point distant about seven miles from Melbourne, and at a level approaching 300 feet above the lowest part of Melbourne, and 150 feet above the highest; a distributing reservoir with filters, &c., is intended to be constructed. From this distributing reservoir I propose to lay down one pipe for the present supply of the city; but, at any time by laying down a second line of pipes to the distributing reservoir an additional supply can be obtained, and should it ever be required, a second or even a third line can be laid from the store to the distributing reservoir.

Many objections have at different times been raised to the scheme of supplying the city from the Plenty; and, it has been stated that the supply of water will be insufficient.

No objection has, however, ever been raised by any practical man, and I purpose, at no distant date in another paper, to endeavour to show to the members of this society, that the whole of the objections that have been raised have been made by parties who have either wilfully misrepresented facts; or, have been incompetent to distinguish between reliable evidence and the contrary; and I would here venture to remark, that the knowledge which is acquired by practical men during many years' experience has been hitherto too much neglected on engineering works in the Australian Colonies. I am, myself, of opinion that the supply which can be obtained from the Yan Yean Reservoir will be amply sufficient, not only for Melbourne, but for Collingwood, Richmond, Prahran, St. Kilda, Brighton, Williamstown, &c.; and I am persuaded that it is at once the cheapest and most effectual scheme that could have been devised.

The advantages to be derived from the Plenty scheme are also not directly confined to merely supplying water to the inhabitants for sanitary purposes, although that object is of primary importance—the water pressure may be rendered available for working hydraulic engines throughout the city, as well as hydraulic cranes along the wharf; the irrigation of a district of considerable extent may also be considered as an advantage of no mean importance, not only to that tract of country through which the line of pipes will pass, but to the colony generally. I still retain the opinion which I have many times expressed, that great and comprehensive schemes for irrigating many tracts of country, which are now comparatively sterile, will at no very distant date be favourably entertained by the public.

I would conclude this paper by remarking, that even supposing that the loss of water from the Yan Yean Reservoir by evaporation and absorption were thrice the registered loss, in a somewhat analogous case, *i. e.* Glasgow, it would be under four feet, and I have not the least hesitation in stating, from

my own experiments, that the statement that the loss by evaporation only would be nine feet, is entirely erroneous. I propose, however, to enter on this subject more fully in a future paper.

VII.

OBSERVATIONS ON THE PROPOSED LOAN FOR PUBLIC WORKS IN VICTORIA.

BY EDWARD GRAVES MAYNE, ESQ.,

BARRISTER-AT-LAW.

It is not my intention to discuss in this paper the general question of the expediency of a public loan for Victoria. I assume it as settled, that such a loan is to be raised, from English or foreign capitalists, for expenditure on reproductive works in this colony; and I propose merely to consider, whether it is likely to realize all the benefits which are ordinarily anticipated from it, and how far its doing so will depend on its being combined with other auxiliary measures.

A sum applied to the construction of public works must be expended on the three elements of materials, implements, and labour. No matter what intermediate processes it may pass through, it must eventually, so far as it effects its pur-

pose, be transmuted into these several agents; and any augmentation of its amount furnishes increased efficiency so far, and so far only, as it gives increased command of them in their required proportions.

Let us inquire, then, to what extent the acquisition of a loan of some millions will augment the supplies available to this colony of the above elements of production.

As regards the first two, that is to say, the various materials and implements which may be needed, no difficulties, of course, will exist. Every remittance sent to manufacturing countries for their purchase will despatch a corresponding consignment to Melbourne; and we can calculate beforehand, with tolerable precision, both the quantities which will be necessary, and their probable cost.

But these are secondary items in estimating the outlay involved in the proposed project. A far more important constituent, in this country, is the labour which turns them to account. It enters in a much larger proportion into the cost of construction, and affects so vitally every step taken, that any change in its rate of remuneration alters much more essentially the aggregate expenditure to be provided for, and the productive efficiency of a given amount of funds. Private contractors will say how readily such fluctuations of the labour market as we are accustomed to witness here, can make the difference between success and failure in the accomplishment of less formidable enterprises than those to which the present remarks are directed.

Now, suppose a system of public works to be projected, and a certain amount of money to be procured, and appropriated to the hiring of labourers. How far, in this colony, would this sudden increase of available funds draw forth an increased supply of labour to work out the scheme, and how far would it, in all probability, fail of doing so?

I say "in this country," because it is on the peculiar circumstances of Victoria, and its complete dissimilarity from

most old countries in the conditions affecting this question, that the observations I have to make are founded.

In England, and countries similarly circumstanced, there is in all ordinary times a large proportion of the labouring classes either wholly or partially unemployed, and ready to fill any opening for work which may present itself. An accession, consequently, to the capital which operates upon the labour market is immediately met by an increase, both in the number of labourers available for production, and in the extent to which their services are actually employed. I believe that the amount of additional labour which is thus attainable in England for extraordinary purposes is inconceivable by those who have not studied the position of the working classes; and, through its instrumentality, every additional accumulation of capital which seeks the co-operation of labour, will obtain it in sufficient abundance to become fully effective.

In this country, on the other hand, there is, as a general rule, no unemployed class whatever; all who desire occupation for hire being able to procure it constantly, and for as many hours each day as they are willing to work. I do not mean to say that there are not individual exceptions, amongst new arrivals who have not yet learned to adapt themselves to the Colony; or that there may not be temporary local exceptions, where classes, unsuited to the requirements of a particular locality, persist in lingering there from week to week, instead of going where their services are in demand. But I say that these *are* exceptions; and that the general rule here is directly the opposite of what holds in old countries, inasmuch as all who wish to work for hire, are able to secure, and actually are engaged in constant, and full employment.

This being so, suppose a large loan were placed in our hands to-morrow; from what quarter are we to draw the additional supply of labourers requisite for prosecuting the projected undertakings?

It is undeniable that the great rise of money wages which would be consequent upon throwing the borrowed fund into the labour market, and which would first show itself on the works in question, would attract to these a considerable number of the labourers of the Colony. But whence can these men come? with the exception of the few who may chance at the moment to be out of employment,—a number inappreciably small, as I have said—they must be drawn either from the service of private capitalists, or from the gold fields.

So far as they came from the former source, the pursuits of private enterprise would be crippled by their withdrawal; and, in a financial point of view alone, the Colony at large would suffer to an extent difficult to be predicted, from the check given to the development of its resources, in the numberless lines selected by individual interest, and likely therefore to be those of most urgent necessity to the country. Building and agriculture would decline; and rents, and prices of all productions of the Colony would rise.

Nay even the labouring classes themselves, to whose benefit this rise of wages might seem to conduce, however it might injure others, would find their increased money receipts more than counterbalanced by their diminished value in exchange for the necessaries and comforts of life; a diminution which would speedily result from the discouragement of production carried on by private employers.

Again, so far as the required supply was drawn from the population of the gold fields;—and this would occur to but an inconsiderable extent, without a very great enhancement of the rate of wages—it is easy to see that the Colony would be a loser by the diminished production of its great staple, gold. A loss which is not to be measured by the mere reduction of the gold returns, but by the stoppage of all the future production, of which the amount relinquished might have been the foundation; and by the check to emigration

which would ensue from any apparent failure of the mines.

The foregoing being the only sources within the colony, from which supplies of labour can be expected; it is clear that the prosecution of extensive undertakings, by the means referred to, would involve a very material advance of wages, to succeed in procuring workmen in adequate numbers. In fact, since the number of labourers is limited, and that number fully employed, the arrival of a large additional sum, to be expended in hiring workmen, would amount to nothing more than distributing amongst the same number of labourers as before a much larger amount of wages than before, without obtaining in return for it any increased quantity of work. No doubt, by bidding sufficiently high wages on the Government works, men would be procured, and the undertakings carried out. But this would only be effected, as has been shown, by withdrawing these men from their previous employments, and thereby injuring the colony by impairing other and most probably more essential branches of production. At the same time, the works for whose sake these sacrifices were incurred, would themselves be carried out, only with an incalculable waste of the money raised for their construction, through the total inadequacy of the supplies of labour attainable within the colony.

Nor could any material assistance be expected from the adjoining colonies. Their populations are too small, and too well off, to furnish those floating drafts of labour, by which, in old countries, an augmented local demand is so rapidly and abundantly satisfied. Our neighbours, moreover, have learned ere now, that an enhanced money income does not always imply an extended command of the comforts of life; and, although they would hear on the one hand of the nominal rise in the working man's gains, they would learn, on the other, with no less certainty, of the rise of prices by which it would be accompanied and neutralized.

As for immigration from Europe, it is obvious that whatever might be its existing amount, as influenced by other causes, it could not be increased by the attractions of the supposed Government expenditure, (and with this alone we are now concerned,) until too late to prevent the pernicious consequences described. The distance is so great, and the uncertainty felt as to Australian intelligence is so universal, that even should a mere rise of colonial wages occasion eventually any considerable enlargement of the stream of immigration, its effect would not be experienced here, until the works were half finished, and the mischief already done. It is to be remembered, too, that in Europe, as well as in the adjoining colonies, the attractions of high pay would be counterbalanced by the concurrent accounts of high prices.

If, then, the policy under discussion involves the waste of money, and the derangement of general industry, with its attendant evils, which have been pointed out as likely to ensue from its adoption, it is worth considering how far these evils may be obviated, and the fullest possible advantages of the scheme secured by subsidiary measures.

The only method which occurs to me of averting the ill consequences adverted to, is the somewhat matter of fact expedient, of importing the necessary supply of labourers from Europe, as we do such other requisites as can be obtained thence more advantageously than elsewhere. If it be worth our while to introduce into the country a large addition to our wages fund, it will be equally so to introduce along with it a corresponding accession to our available labouring classes.

To what precise extent, or by what machinery, this should be effected, it is unnecessary to discuss at present. The principle of the suggestion is no novelty in these colonies. We have long since discovered that no more profitable investment exists for our accumulating revenue than in securing a continuous influx of population; and that our

gold does not prove a very beneficial possession, when it is either left locked up in the coffers of the banks, for want of hands to render it productive, or squandered on consignments of goods which rot in the stores from lack of consumers. And, if this truth be admitted, in the case of gradual accumulations of income, it must hold still more strongly with regard to a sudden accession of money, such as we have been considering.

VIII.

ACCOUNT OF THE GUNYANG: A NEW INDIGENOUS FRUIT OF VICTORIA.

BY DR. FERD. MUELLER.

READ APRIL 5, 1855.

The number of fruits indigenous in this colony is so limited, that any addition to them can not fail to attract a far more general attention, than even the most important discoveries in the medicinal properties of our plants, or in their geographical distribution or affinity likely would secure. With this view, I selected from a series of new plants, which were obtained during my last journey through the eastern parts of this colony, the "Gunyang," for an early publication. That the natives apply a special name to this production of our Flora warrants its usefulness in their nomadic life; and as, in fact, the Gipps' Land tribes collect this fruit eagerly, and as probably cultivation will improve it so much as to render the plant acceptable for our gardens, I hope to be excused in not having chosen a more valuable object for a special paper.

The Gunyang bush is a kind of Solanum or nightshade,

and has much the appearance of S. aviculare (S. laciniatum Ait.),* to which species it is, indeed, in habit, so closely allied, that superficial observers seeing these plants growing promiscuously will hardly become aware of their distinction. Yet the differences between them are, through all stages of development in both plants, so clear and so decisive, that I do not hesitate to add to the enormous number of more than nine hundred solana, hitherto described, the Gunyang, as new under the name of S. vescum.

It differs from S. aviculare in green but not dark purplish twigs, in sessile decurrent, somewhat scabrous, and less shining leaves, whilst those of S. avicular are distinctly pertiolate, and, consequently, not decurrent along the twigs, in more tender corollas, which are very slightly, but not to the middle, five-cleft, and hardly ever outside whitish, in thinner styles and filaments, the latter not shorter than the anthers, in more acute teeths of the calyx, in almost sperical transparently green berries with large seeds. The berries of S. aviculare are, in contrary, at all times exactly egg-shaped, of an orange colour, and with seeds but half as large as in S. vescum. The natives of Gipps' Land, moreover, reject the berries of the former on account of their disagreeable taste. To the Peruvian S. reclinatum the affinity of our plant appears yet greater; yet in the careful description, which Dunal has furnished of it in Cand. Prodr. xiii. p. 68, neither the characteristic wings of the twigs are attributed to the Peruvian plant, nor do his remarks on the corolla, which he calls half-five-cleft, on the shorter pedicles and smaller calyx agree with S. vescum. A close approach between both is, however, manifested in the length and structure of the filaments, as also in the shape and colour of the berries. From S. senecioides and multifidum, likewise inhabitants of Peru, our species differs already in the division of the leaves, but bears resemblance to them in the winged twigs.

* The Kangaroo apple of the colonists.

The Gunyang has been found, as far as I know, only yet in Gipps' Land, where it occurs on sand ridges around Lake Wellington, on the coast towards the mouth of the Snowy River, on grassy hills at the Tambo, the Nicholson's River, and Clifton's Morass, on the rich shady banks of the Latrobe River, and near the Buchan River. The occurrence of the plant in such varified localities proves how easy it may be cultivated in any soil. It flowers during the spring, and ripens its fruits towards the end of the summer. The berries lose only their unpleasant acridity after they have dropped in full maturity from the branches, and then their taste resembles in some degree the so-called Cape-gooseberry, (Physalis Peruviana), to which they are also similar in size.

In conclusion to these remarks, I beg to offer the botanical diagnosis of the Gunyang plant, supported by a description, which, I hope, will facilitate its recognition.

Solanum vescum, n. sp.

Fruticose, unarmed, erect, smooth; twigs winged; leaves large, sessile, long lanceolate, undivided or furnished towards the middle, on both sides, with one or two lanceolate segments; calyx of the corymbose flowers to the middle; five-cleft, with thick subdeltoid cuspidate unkeeled lobes; corolla, smooth, somewhat folded, violaceous, almost bell-shaped, with five very short lobes; filaments thread-like, equal in length to the yellow oblong anthers; berries large, green, nearly globose.

A shrub, with spreading branches, sometimes more than six feet high, but already in the first year producing flowers and fruits, by which means the plant appears then to be herbaceous. Branches woody, covered with a brownish-grey wrinkled and fissured bark. Leaves decurring along the twigs, hardly shining, beneath a little paler, generally somewhat scabrous; middle rib of the leaves and their segments above sharply prominent, beneath yet more protrud-

ing, and these semi-terete; the lateral nerves numerous, patent, and conjoined by veins. Corymbs axillary, few-flowered, either solitary or twin, sometimes cymose, sometimes racemose. Peduncles terete, often slightly angulate, from one to two inches long, rarely wanting. Pedicels as long as the peduncles, terete, solitary, gradually passing into the calyx. Calyx nearly campanulate, in age carnulent; the teeth at length 2—3 lines long. Corolla tender, lilac-blue, nearly all times of an equal colour, but rarely outside with exception of the wing-like part greenish, undulate at the margin; the lobes either rounded or emarginate. Stamens considerably shorter than the corolla; filaments very thin; anthers $1\frac{1}{2}$ lines long, opening at the apex, but also bursting more or less longitudinally. Style white, longer than the stamens. Stigma capitellate, bilobed. Berries when perfectly ripe pulpy, sometimes above one inch long. Seeds ovate-roundish, compressed, with a grey net-like tissue.

IX.

ON THE MINERAL WATERS OF VICTORIA.

BY JOHN MAUND, M.D.

READ APRIL 5, 1855.

My object in presenting for the inspection of the Institute this specimen of mineral water with a quantitative analysis of its composition, is principally to direct the attention of our members to the probable existence of many valuable mineral

springs, and to point out several which have already been discovered in Victoria.

Thus I may mention that I have met with two specimens of *acidulous* water derived from different parts of this Colony, one from Hepburn, near Castlemaine, and another from the banks of the Merri Creek, about thirty miles from Melbourne. A third, I have been told, exists at Ballan, of which I hope shortly to obtain a specimen. The waters derived from the two former localities contain a very considerable quantity of free carbonic acid gas, which imparts to them an agreeable and acidulous taste and a brisk and sparkling appearance. Time has only permitted me to make a quantitative analysis of the former, the results of which are the following.

RESULTS OF THE ANALYSIS OF MINERAL WATER FROM HEPBURN.

	Per lb. Grains.	Per Gallon. Grains.
Carbonate of Lime . .	4·747	47·470
Carbonate of Magnesia .	2·570	25·700
Carbonate of Soda . .	4·380	43·800
Carbonate of Iron . .	0·100	1·000
Chloride of Sodium . .	0·640	6·400
Sulphate of Soda . .	0·223	2·230
Phosphate of Alumina .	trace	trace
Phosphate of Lime . .	0·030	0·300
Phosphate of Iron . .	0·182	1·820
Alumina	0·100	1·000
Silicic Acid	0·330	3·300
Organic Matter . .	0·097	0·970
	13·399	133·990

The quantity of carbonic acid I have not yet definitely ascer-

tained, as accurate results could only be obtained by its estimation being made at the spring, but I believe from the experiments I have instituted, that 100 cubic inches of water will contain at least 100 cubic inches of the gas. The water now produced, which was derived from Hepburn, I should feel inclined to class as an acidulo carbonated chalybeate. It would, however, I am aware, by some authorities, from the small quantity of iron that it contains, be classed merely as an acidulo alkaline; and indeed, as the presence of iron does not render the taste disagreeable, it might with equal propriety be classed under either head. Acidulous waters of this kind have always been held in high esteem, even so early as the time of Pliny (who was about coeval with our Saviour) who particularly mentions a spring of this description which existed in Macedonia, which he states possessed intoxicating properties (Lyncestis aqua, quæ vocatur *acidula*, vino modo temulentos facet), and for which properties the Pyrmont water is said now to be extensively drunk by the country people. This effect doubtless depends upon the large amount of carbonic acid the water contains.

Great Britain possesses, as far as is yet known, only one acidulous spring, this exists at Ilkeston, in Derbyshire, and has acquired considerable celebrity, although its properties are far less deserving of attention than those of the water now presented for the inspection of the society.

The imperial gallon of the Ilkeston water contains only about 36 grains of saline matter per gallon, while that of Hepburn contains about 144 grains in the same amount. The importance of such springs to the Colony will be readily appreciated when we consider that they are of the same class, and, I believe, equal in every respect to the far famed Seltzer Water of Germany, which attracts such hosts of travellers to the Rhine, and is so extensively imported into England and elsewhere, thereby producing a considerable revenue to the country affording it. The water now shown, from the cork

having been frequently removed from the bottle, has lost its free carbonic acid, and consequently its acidulous taste. It is now instead strongly saline and alkaline, and although the water is now clear, I should mention that a portion of the salts have been deposited, owing to the escape of carbonic acid, the presence of which kept them in solution.

The medicinal effect of the Hepburn and other waters I have referred to are not of a slight character. The excess of carbonic acid makes them refreshing and exhilarating, and useful in allaying nausea and irritation of the stomach, while the salts they contain act directly on the renal and digestive organs, rendering them extremely beneficial in hepatic, gouty, rheumatic, and other affections. In addition to the acidulous waters I have seen several specimens of saline waters, derived from springs which exist mostly on the sides of creeks; I believe, ultimately, springs of this class will be found in many parts of the Colony.

The composition of those I have analysed consist chiefly of chlorides of sodium, magnesium, and calcium, with sulphates of soda, magnesia, and lime, and occasionally iron, alumina, and traces of potash.

I have been informed that near the Ovens Diggings a sulphureous spring exists, but a specimen of this water I have not been able to procure; I trust, however, some member of our Society, who has friends in that neighbourhood, will be more fortunate, and present the Institute with a specimen.

The specimen of white powder now shown (which was sent to me by Mr. Moody as a product of the Anderson's Creek Diggings) is the remains of some beautiful, transparent, naturally formed crystals, which have now from exposure to the air effloresced. These I believe to have been the solid portion of a saline mineral water, which percolating through a rock into a cavity, were deposited in consequence of the evaporation of the aqueous part, leaving the inorganic constituents in crystals on the sides of the cavern. The crystals

consist mostly of sulphates and carbonate of soda, with small portions of phosphate of soda, sulphate of magnesia, and potash, there being an entire absence of chloride of sodium and chlorine.

X.

ON GAS AND GAS WORKS.

BY A. K. SMITH, ESQ., C.E., F.R.S.SA., &c.

ENGINEER AND MANAGER OF THE CITY OF MELBOURNE GAS WORKS.

READ MAY 3, 1855.

Mr. Chairman and Gentlemen,—I beg to preface my remarks on Gas and Gas Works by stating that, although I have had considerable experience in the erection of gas works, the manufacture of coal gas, and its introduction to towns and houses for public and private uses, yet I have found it advisable to refer to such authorities as Dr. Fyfe, Messrs. Thompson, Faraday, Hughes, Gore, Rutter, &c., &c., regarding its early history, chemical analysis, &c., &c.; and as there are several interesting papers to be read this evening, I shall not attempt more than to give a brief outline of:—

1st. The history and nature of coal gas.

2nd. A description of the works necessary for its manufacture.

3rd. The adaption of these works to suit local circumstances.

4th and lastly. The application of gas to public and private uses.

1st. The subject of light, natural or artificial, has claims on all classes of society, for it is the duty of every person to study the sources from which health or domestic comforts spring, and to understand, in a certain degree, their application, the more so as the means of inquiry and investigation have been brought to a wonderful degree of simplicity and perfection, and every step thus gained increases the hope that in the end many of the seeming mysteries bearing directly on our comforts will be made clear to the searcher of the truth.

The present century has been aptly termed the age of mechanical inventions. Philosophy, arms, the arts, and literature, have had respectively their periods of eulogy, each in its turn has borne its sway over the minds and hearts of mankind. The advent of mechanical science came, and at last the genius of the steam-engine, the loom, and the printpress rose gradually into the ascendant; almost every branch of manufacturing industry bears witness to the wonderful effects which may be produced by the ingenuity of man through the medium of mechanical inventions, when his faculties are stimulated and sharpened by the necessity of supplying manual by machine labour. That coal gas, as at present manufactured and stored in the gas holder, does so, I propose to render evident, and to show that the simple movements of that apparatus, so far and in so many instances, ministers to our comforts, and substitutes, by its insensate obedience to mechanical laws, the combined saving of time, trouble, and expense, which are rendered necessary in the produce and distribution of all artificial light.

It would be out of place to give anything like a history of the rise and progress of gas lighting, suffice it is to say that amongst its foremost apostles figured the names of Murdock, Trevethick, Clegg, Dr. Henry, Watson (Bishop of Landaff), &c., &c.

The discovery and earliest observation of gas lighting by elastic or aeriform fluids, capable of being inflamed and of imparting light and heat, must, undoubtedly, have been of great antiquity. The most ancient writings contain notices of inflammable vapours springing from fissures and cavities in the earth. It is evident, therefore, that gas being a natural production, no such being as the inventor or discoverer of gas ever existed. Modern chemistry will have no difficulty in showing that all inflammable gases, whether arising naturally from rocks, or produced artificially by combustion or otherwise, are composed of very simple elements, and all present a remarkable analogy to the common carburetted hydrogen, which is the gas chiefly burnt in our street lamps and houses of the present day.

Inflammable gas may truly be said to be as old as the creation of organic matter, for whatever animal or vegetable substances have existed by the immutable laws of nature, they have been subject to decomposition; and whatever decomposition has taken place, a variety of gases have been produced, some of them inflammable, and others not so. Whether the decomposition be that caused by the slow action of decay, or that more rapid process by the application of sensible heat, the effect is the same; the gases are equally produced in the two cases.

Gas may be with more truth called a natural production than steam, although the latter has existed from the first creation of water, and in its palpable state, as proceeding from boiling water, must have been observed in all ages. The discoveries of man, with respect to gas and steam, ought rather to be called applications; they are conquests over elements, the subjugation of great powers in nature to his use and convenience. So it is with all great inventions in which we find one power of nature after another chained, confined, bound down, stored, and then let loose when required; and made to work machines and to propel ships across the ocean, to supply

the place of human labour itself in a thousand varieties of ways; nay, to pass far beyond the bounds of human labour, and effect, by a single effort, that which the manual strength of the whole world would scarcely accomplish. If such astonishing applications of steam and gas had been made in the days of ancient Greece, what magnificent, all expressive, world astounding, names would have been found to convey their meaning, instead of such contemptible little monosyllables as gas and steam; one might have heard of the spirit of coal and the spirit of water, with some superlative adjective to stamp the vast importance of each. In such an age these wonderful conquests would have thrown all meaner efforts into the shade; for them alone poetry would have strung her harp, and the grandest epic productions of genius might have commemorated the victory of man over the inanimate matter of nature, instead of dedicating her loftiest songs to that curse of all ages and nations—the art of war.

The avidity with which the early nations seized on all natural phenomena, and all exhibitions of natural powers, is evident from the great veneration paid to the burning flames which issued forth from the fissures and cavities in the earth, where lakes of naphtha existed, or in the neighbourhood of coal districts. Some of the earliest nations have considered fire a type of divinity; and we can scarcely wonder at the feelings of veneration and superstition occasioned by mysterious outbursts of flame, whose origin appeared utterly incomprehensible. Hence superstition erected her altars over such flames and claimed the interference of the gods to sustain the perpetual miracle, but all that had been observed with reference to the inflammable vapours of ancient times was very far indeed from approaching to anything like a useful purpose. Far from leading to any attempt to collect any of these vapours, their very nature and composition were unknown, and the most mistaken ideas prevailed as to their real elements. It was not until modern

chemistry had exploded volumes of ancient dogmas, had traced the so-called elements to their simplest forms, and had taught us the law according to which the elements are combined in order to constitute all forms of matter. It was not till then that it began to be seen that the inflammable matter of coal, wood, oils, and other fatty substances, was analogous with the marsh gas, which arises in bubbles from the decomposition of vegetables under water; that it was of the same nature as the fatal "will o' the wisp," which on the wild moor or bog has lighted many a weary and benighted traveller to destruction; finally, that it was nearly the same as that which arises from the decomposition of water however produced; and that, in fact, one of the constituents of water, the greatest antagonist and extinguisher of flame, was itself the most inflammable substance in nature, namely, hydrogen gas; while oxygen, the other element of water, is the greatest known supporter of combustion.

All organic bodies, that is to say, all bodies derived either from the vegetable or animal kingdoms, will yield gas when decomposition takes place. When such decomposition is effected by means of heating organic matter in close vessels, the gas may be collected, and when confined so as to be allowed to issue in a small jet only, from a minute orifice, the jet may be ignited and made to burn so as to give out light, and at the same time heat sufficient to inflame other portions of gas as they issue forth, and so keep up the continuity of flame.

The gases so derived are named after the chief constituents of organic bodies; thus we have

Hydrogen gas.
Oxygen gas.
Nitrogen gas.
Carbonic acid gas.

Named from the elements hydrogen, oxygen, nitrogen, and

carbon, which constitute the principal parts of all organic matter. We have also gases named after a combination of these elements either with each other or with foreign bodies, frequently with organic matters, as

Carburetted hydrogen gas.
Sulphuretted hydrogen gas.
Carbonic oxide gas.

These names are so expressive that it is scarcely necessary to explain that carburetted hydrogen is a compound of the vapour of carbon with hydrogen, that sulphuretted hydrogen is a similar compound of the vapour of sulphur with hydrogen, that carbonic oxide is the vapour of carbon in combination with oxygen, &c., &c.

Coal and other bodies capable of yielding gas by distillation are composed chiefly of oxygen, carbon, and hydrogen.

When the heat reaches a certain point the combination of their elements is destroyed, and they enter into new combinations, the principal of which are the various gases arising from distillation. Thus, when one volume of oxygen enters into combination with one volume of carbon, carbonic oxide is formed; and when another volume of oxygen is added, acid gas is produced, called carbonic acid gas. Again, at one part of the process, nearly pure hydrogen is liberated, another portion of gas is formed by carbon, combining in the proportion of one volume of carbon to two volumes of hydrogen; and lastly, olifiant gas is the product of equal volumes of carbon and hydrogen entering into combination.

In all the contrivances which have been used for the production of gas from fatty matters, either in lamps or in the form of candles, the various component parts of gas, as the carbon and hydrogen, are actually vapourized and put into the form of gas before their combustion takes place. In this point of view, every wick burning in any kind of lamp or candle, is, in fact, a small laboratory for the production of gas, which is burnt or consumed at the instant of production.

It was reserved for the chemistry of our own days to point out this analogy, as it was reserved for the practical skill of engineers and mechanics to bring to perfection the means of producing this gas on a large scale, of storing it for consumption, and then sending it forth whenever required into our streets and houses, to communicate light, and enable mankind to pursue their useful and laborious vocations when darkness shrouds the earth, as well as in the light of day.

A beautiful action takes place in the combustion of an ordinary lamp or candle, in which the wick, surrounded by flame, represents a series of capillary tubes, to convey the melted matter in the form of gas into the flame. This action will be very apparent to any one who will watch the process of combustion in an ordinary wax or tallow candle. First he will perceive a cup of melted matter around the wicks, in which a great number of small globules are seen constantly in progress towards the wick; many of these globules are also seen standing on the wick, studding it all over like sparkling diamonds. Let us consider what the globules contain. They are filled with the inflammable gas produced by the heat applied to the melted wax or tallow; but fortunately for the success of this method of burning these globules do not break and set free the gas until they come in close contact with the flame, when the heat becomes so great that the expansion of the gas causes each little globule to break, and add its contents to the already existing flame.

How admirable is this provision, how exquisitely constituted are the properties of nature, to cause this beautiful result. In every common candle we behold an apparatus of refined ingenuity, in which gas is being inclosed in little microscopic pellicles, which are floated to the base of the wick; there hundreds of these little globules are seen ascending the wick, while hundreds of others are every instant exploding and discharging their contents into the flame, which is thus made up by the instant combustion of gaseous matter,

at the moment when it leaves the liquid form, through the medium of this intermediate stage.

It is obvious, if the gas were to be actually formed at the surface of the small cup of melted matter already spoken of, the surface being usually half an inch below the nearest part of the flame, that the gas would immediately diffuse itself through the air, and combustion would not take place. It is only through the property which the gas possesses, of taking an intermediate form, and not finally assuming its gaseous condition till it reaches the flame, that the effect of continued combustion is preserved.

Before proceeding to consider the various products produced by the distillation of coal, as practised in gas manufacture, it may be useful to glance at the origin of the word gas. The word is very slightly altered from a German monosyllable of the same sound, signifying the ebullitions which attend the escape of aeriform fluids from substances in a state of effervescence.

The gaseous products arising from the distillation of coal may be divided into three classes. 1st. Those which are valuable for purposes of illumination, as the olefiant gas and the hydro-carburets, or vapours of volatile oil. 2nd. Those which burn with a blueish flame, and give out very little light. These are simply hydrogen gas, carburetted hydrogen, and carbonic oxide. 3rd. The injurious products that require to be separated by purification, not only on account of the evil effects arising from breathing them, but also on account of the injury to colours, &c., &c. These are carbonic acid, ammoniacal gases, sulphuretted hydrogen, and sulphuret of carbon, cyanogis is another product of distillation, due, like ammonia, to the presence of nitrogen in the coal, and, when any alkaline matter is present, cyanates are frequently found.

Coal is the remains of vegetable matter. This fact, I dare say, you are all aware of, so I shall not enter into a description of the different stages through which coal has passed,

before it presents itself to us as the ordinary mineral coal of commerce.

Suppose, for instance, we have to decompose a piece of coal. We find that it contains carbon, hydrogen, nitrogen, and oxygen, in certain proportions, combined with lime, silica, sulphur, iron, and other impurities. Our object is now to obtain, for the purpose of gas manufacture, three ingredients, namely, carburetted hydrogen for light, the compound of nitrogen for chemical purposes, and the unconsumed or uncombined carbon for the purpose of fuel. Heat is the agent by which we effect the work, and it is therefore of importance to know the best means of employing that heat so as to effect the object in view in the most speedy, economical, and satisfactory manner. In order that the required substances might be evolved in sufficient quantity, we must have a proportionate amount of heat; for, if we wanted to extend a piece of coal to 270 times its bulk, the amount of heat applied must be equivalent to the force requisite to produce such a separation and expansion of its atoms. Those atoms, it must be recollected, had no disposition in themselves to move or change, the expansion must, therefore, be effected by some external agency, and rightly applied.

In order to produce gas the coal must be expanded to 270 times its bulk, and if the amount of heat applied does anything less, then, instead of producing gas we should only produce a liquid. One word as to the nature of pure and impure gas. When we make use of gas for the purpose of light we should remember that, however advantageous it might be to us to have it perfectly pure, yet we could not obtain artificial light without having a certain amount of residual products. The light from the sun leaves no products, but all artificial light must of necessity yield products, because matter, though it may undergo a change, is perfectly indestructible. Whether a certain mass of coals was consumed in a fire, or a furnace, or in a gas retort, the amount

of the weight of the products would be always the same, we should still have the carbon of the coal uniting with the atmosphere, and producing carbonic acid; and the hydrogen of the coal producing water, and the nitrogen given to us in the same condition, and all the remaining products have only undergone a change as to form; therefore, it was a matter of importance to us, that in any material to be used for the purpose of giving light, its products should be as innoxious as possible. If we take coal in a perfectly crude state, and submit the gas derived from it for the purpose of illumination to a test, we shall find that it contains, first, a quantity of sulphuretted hydrogen, we shall have the carbon and oxygen uniting, giving us carbonic oxide and carbonic acid, both of which are deleterious; then the carbon and nitrogen combined, giving us cyanogen, which is the base of "Prussic acid," the well-known poison. Hydrogen and oxygen combined, giving water, hydrogen, and nitrogen, producing ammonia, oxygen and nitrogen, combined producing nitrous acid; so that these elements in their composition would give rise to (with one exception) a mass of poisonous products. But if we can get rid of the oxygen and nitrogen from our gas, we shall then have brought down our absolute poisonous products to carbon and hydrogen; and these, in the process of combustion, uniting with the oxygen of the atmosphere, would give us carbonic acid gas. Sulphur, in a state of combustion, being injurious to health, you will readily understand the necessity of removing every trace of it which the gas may contain. Doubtless, many of you may have heard of, and some unfortunately experienced, the effects of bad and impure gas, as in the eyes also on goods in linendrapers' establishments, book-bindings, picture-frames, &c., &c.

A case of this kind lately occurred at Blackheath. There a gentleman had in a room, about twelve feet square, a three-light chandelier, there was no ventilation. This gentleman was constantly complaining of a headache; his medical ad-

viser told him the gas was not good. On complaining to the company which supplied it, he was informed that he had too much light in proportion to the current of air—that, in fact, he had a quantity equal to twenty-six penny candles, and that what he wanted was ventilation. He had a ventilater placed in the window, and the result was that the headache left him, and the gas was found satisfactory. If the public do not take the ordinary means of preventing danger or inconvenience, it will not be surprising if they feel annoyed. I throw out the hint because I know that gas must be far more extensively used than at present,—gas must eventually become the light of the masses—it is so in Scotland; and until it is so more in England and other parts of the world, it will not have accomplished its mission.

Secondly—In commencing to give a description of the works and apparatus necessary for the manufacture of gas, I shall advert, in order to be better understood, to those which will be erected at Melbourne. Some three or four years ago it was thought necessary to have a part of the public streets, trade premises, and houses of Melbourne lighted with gas. A public meeting was held and a company formed. A piece of ground for a site was purchased in the lower part of the city about 95-100th of an acre. The discovery of gold immediately after took place, and the works were for a time abandoned, or, at least, proceeded but slowly. The immense increase of the population of Melbourne in the years 1852 and 1853-4 rendered it absolutely necessary that the works should be erected on a larger scale, in order to keep pace with the rapid increase of Melbourne, which, from a town of 20,000 inhabitants in 1851, rose in eighteen months to 70,000; an increase of population, for a town of the same size, unparalleled in the annals of the world. It was determined that the company should have their manufacturing apparatus for the works from Britain, owing to the advance in price of labour in the Australian market. The propriety of at once

obtaining a large site some distance from the town was apparent; accordingly suggestions were sent out from Britain, accompanied with satisfactory reasons for such advice. The promoters of the scheme here made application to the Government for a larger site, and eventually obtained a grant of five acres for twenty-one years; such site was well chosen in reference to economising the carriage of raw material used in the manufacture of gas, but otherwise ill adapted for the erection of buildings, &c., &c., owing to the difficulty and expense of obtaining foundations for the same, and in taking precautionary measures against flooding by the river Yarra. The low level of the site and the difficulties to contend with will appear more manifest, when I mention that twelve months ago, the surface of the ground at the south end of the works and upon part of which the present retort-house now stands was below the low water level of the Bay, and consequently covered by each side to a varying depth of from two to four feet at high water.

Before the erection of the works, it is necessary to have some definite information as a guide regarding the size they ought to be, in order that the capabilities for production may equal the demand for consumption; this is generally done by taking a list of the trade premises, private and public houses, churches, chapels, and street lights, &c., &c.; then, according to local circumstances, leaving a large or small margin in favour of the works. In other words, if a city or town has little staple manufacture, such as York, Canterbury, Bath, Exeter, Rome, &c., &c., then the works are generally made just of sufficient size, and the pipes running along the streets of just sufficient calibre to supply the existing wants of the community. And on the other hand, if the town or city has an extensive trade in commerce or manufactures, it is obviously better to construct the works, leaving a wide margin for extension, in such places as London, Newcastle, Glasgow, Birmingham, New York, San Francisco, Melbourne, &c.

To proceed with our illustration, the Melbourne gas works, it is determined to construct them of the following sizes and capabilities:—there are to be 120 retorts, each retort to produce, when working, 4500 feet of gas per day, that is—it will carbonize 10 cwt. of Newcastle coal, which produces on an average 9000 feet of gas per ton. We therefore multiply the 4500 by 120, and find that the total quantity of gas produced by the whole number will be 540,000 cubic feet. This quantity, when consumed at the rate of 5 feet per hour, will afford a light equal to that derived from 1,512,000 sperm candles, consuming at the rate of 120 grains per hour. I find that the total illuminating power of the gas, obtained from sixty tons of average coal, is equal to that obtained from 10 tons 16 cwt. 1 qr. 20 lbs. of sperm candles, and the relative cost of the same at the present market price of 2s. 6d. per pound; and say gas, as charged in the city of Springfield, United States, at 6 dollars per 1000 cubic feet; it is 7 dollars or 29s. 2d. per 1000 in Augusta, United States, stands thus:—

24,240 lbs. sperm candles, at 2s. 6d. ...	£3030
540,000 feet of gas, at 25s.	675
	£2355

or gas has the advantage of being nearly four and a half times cheaper than sperm candles, giving equal amounts of light.

Having now stated to you the capabilities for making gas, as far as quantity is concerned, I will now endeavour to show how the operation is carried on.

Let us take one retort, which I must beg you to understand is a cast iron or clay vessel of about nine feet in length and fourteen inches in diameter, open at one end. This retort is fixed above a furnace, and simply shielded from the

intense heat of the fire by thin slabs of fire brick; this is necessary in order that the iron retorts may not be melted. Suppose the fire underneath to be kindled, it is gradually fed by coal or coke for two or three days, care been taken not to get the heat up too suddenly until the colour of the heated retort above presents the appearance of a bright cherry red; the retort is completely enveloped in brick work, with the exception of the mouth piece, spy holes are left in the front in order that the fireman may look in from time to time and examine the colour. As soon as it assumes the colour above mentioned, a charge of coals varying in weight from 150 to 250 lbs. are expeditiously thrown into the retort, and the open end is immediately covered over by a door which is luted with clay or lime mixed up into a paste-like consistency, so as to effectually prevent the gas escaping from the mouth of the retort. The closing of the mouth also effects another object, viz., the exclusion of the atmosphere, without which no combustion can take place.

The coals now fastened securely within the retort are immediately subjected to the heat of the red hot retort, and the smoke or gas in its first stage commences to rise in the ascension pipes, towards the hydraulic main, in which their ends dip a few inches below the level of the water. The hydraulic main being a cast iron cistern half full of water, in which the gas, as it forces its way through, deposits the major part of its ammonia and tar; the gas partially purified immediately ascends through the top of the hydraulic main, and is forced away by the pressure of the gas generating in the retort below, in conjunction with its own specific gravity, into what is called the condensers, which are a series of upright pipes, in which the gas ascends and descends, thereby cooling and condensing. Each time the pipe reaches the bottom of the cistern it also dips into water, and so washes and purifies the gas still more, while its condensation causes

it to precipitate some of the impurities still left after passing the hydraulic main. The gas, after being so washed and cooled, has deposited all the tar and most of the ammonia, which was held in suspension, but it still possesses further impurities, namely, sulphur and sulphuretted hydrogen, in order to get rid of which it has to pass through the dry and wet lime purifiers. These are vessels containing a solution of lime in the one case, and moist lime in the other. The lime, having a strong affinity for sulphur, the gas, in coming into active contact with it is robbed of this, its last impurity, and then passes away to the metre, to measure its quantity, before passing into the gas holder: I say measure it—as it passes into a vessel divided into several compartments, and half immersed in water, in passing through which it causes the cylinder to revolve, and thereby gives motion to a piece of mechanism, which accurately registers any quantity passing through it, from one foot to one hundred million feet. After leaving the gas metre, or station metre, as it is called in contradistinction to the other metres used by the consumers, the gas passes away to the gas holder; this is the storehouse in which it is kept as it is made during the day, ready for the night consumption. Such storehouse is necessary for this reason, that as the gas is made at all hours, and the demand only occurs for about an average of five hours, it is therefore necessary to store that quantity made during the nineteen hours of the day. At Melbourne, the gas tank will be a vessel of cast iron, twenty-one feet deep by eighty-one in diameter, and possessing storage room for about three thousand three hundred tons of water, with which it will be filled; the gas holder floats in the water, and contains above one hundred thousand feet of gas when full. We have now traced its mode of manufacture from the retort where the coal is carbonized and the gas generated, until it passes the hydraulic main, there leaving a deposit of tar and ammoniacal liquor,

from thence to the condensers, where it is cooled and further robbed of its impurities; from thence again to the wet and dry lime purifiers, in which any quantity of sulphur it may contain is abstracted; then it passes away from these to the station metre, to register the quantity made; and lastly, to the gas-holder or store-room, in readiness for use. Before leaving this part of the subject, I may mention that there are three things of importance in the manufacture of gas, to each of which especial attention must be paid—namely, the quantity, quality, and cost. Gas, of course, is manufactured by a company, for a two-fold object—to supply a great public want, and to afford a fair return of interest for moneys expended, or profit under good guidance to the producers. In order that it may do so, attention must be paid first to its quality, seeing that it contains no impurities; secondly, to the quantity produced from each ton of coals, that any waste by careless workmen may be checked; and thirdly, to its cost in production, that the company may be remunerated for their outlay.

The qualities of gas are not a mere matter of opinion, but, on the contrary, are based upon scientific foundations, and by the aid of chemistry are rendered evident to the senses. In order to detect the presence of sulphuretted hydrogen in the gas, a piece of common writing paper is moistened by a solution of acetate of lead—perhaps better known to you as sugar of lead—this held over a jet of gas will indicate the presence of sulphuretted hydrogen by turning black. The test for ammonia, which is an alkali, is indicated in a similar manner by either yellow turmeric, or litmus paper, first reddened by vinegar or any other weak acid. If the gas contains ammonia it restores the turmeric and litmus papers to their original yellow and blue colours; if it is free from that impurity the red colour of the changed paper remains unaffected. Again, in like manner, the presence of carbonic

acid gas or any combination of sulphuric acid is determined by the blue tincture of litmus paper being changed into red.

By these means gas, in each stage of its manufacture, may be tested, and the papers used by the foreman are daily filed, for the inspection and approval of the engineer and manager, who preserves the same as a record of what has been done on that particular day. Next comes the quantity from each ton of coals. This is easily determined by the aid of the station metre, in this way: We will suppose that sixty retorts are at work, containing each exactly two cwt., or six tons in all, and that the station metre indicates 1,500,000 feet of gas; if, after the duration of six hours, we find that the retorts have ceased working, and that the index of the station metre is at 1,554,800, we then subtract the less from the greater, which leaves us 54,800 feet from six tons, or a little over 9,000 feet per ton. But this quantity depends entirely upon the quality of the coal used, some specimens giving as low as 6,500 feet per ton, others as many as 15,000 feet.

Next in order comes the cost, an important item to the company, next to the quality. I say next to the quality; for if they do not manufacture a good article, no one will purchase.

The cost of the gas is determined in this manner:—Take the last instance of 54,800 feet from six tons of Scotch cannel and English gas coal. As these coals will come from the British isles the cost will be say, delivered, £6 per ton; therefore, six tons costs £36; to which add cost of coal for carbonizing, workmen's wages, officers' salaries, a proportional share of the interest of the capital invested, and an allowance for wear and tear of retorts, and a contingent fund, at the same time giving credit for the residuary products from the distillation of the coal, such as the coke and coal tar, and the salts of ammonia, &c., &c. After subtracting their value, (which is simply what they will sell for,) from the above, it will leave, when divided by fifty-four, the selling price of 1,000 feet of gas.

Having now ascertained the cost per 1,000 feet to the consumer, we now come, in the third place, to the mode of distribution to the various localities where required. One or more large pipes are laid down from the gas-holder, along the principal approaches to towns or cities, or in the main streets thereof. The size of the main pipe laid down from the Melbourne works along Flinders-street is twenty-four inches in internal diameter, and will discharge 160,000 feet per hour, thus leaving a wide margin for the future, and, I may say, certain extension of Melbourne. Here I may at once settle a question that has been discussed pretty freely, as to whether the pipes are large enough for even the present city and suburbs, by stating that the main here described is of sufficient size to discharge, under a moderate pressure, twice as much gas as would supply the present cities and towns of Melbourne, Sydney, Adelaide, and Geelong; being five and three-fourths times as large as those employed to light the city of Amsterdam, with a population of 202,000, and nine times as large as those in Sydney. As soon as this pipe passes the entrance to King-street, a branch pipe, suitable in size for the wants of that street, always bearing in mind the chances of its extension, is laid down, and from which the west end of the city and Hotham Ward will eventually be supplied; and so on with all the other streets and suburbs of the city. When a street intersects or opens upon a lane, small branch pipes are laid on, in order to supply residents there, or any public lamps that may be required. Supposing that all the streets are supplied with pipes, it is expected that the sanitary commissioners or lighting committee will at once proceed to erect a suitable number of lamps in the city and the suburbs. These lamps are placed generally in well-lighted cities at about thirty-three yards from each other, and seldom vary, unless by their doing so they can bring a lamp to the end of another street or lane, where it may diffuse its light and

perform the duty of two distinct lamps, at the cost of one. The City Council intend to light the public streets and thoroughfares of Melbourne with about 2,000 lamps, 1,000 of which are intended to be fixed first at average distances of say seventy yards, leaving space for the introduction of 1,000 more subsequently, without altering those already fixed. This is a better arrangemeut than to light half the city first, and cannot fail to give satisfaction, as it provides for a general diffusion of light amongst those who are taxed to pay for it, rather than the monopoly by one part of the city at the expense of the other. The other public purposes that gas is generally applied to are the lighting of churches, chapels, &c., &c.; one of great utility, namely, that of illuminating dials of steeple and other clocks, thus allowing to be seen

> "How steals the march of time away,
> By night as well as broad noon day."

(To be continued.)

XI.

PHONETICS.

BY W. CLARSON, ESQ.

Mr. Chairman and Gentlemen.—The paper I have to read before you this evening is upon the phonetic repre-

sentation of language, as developed in phonography, or writing by sound; and phonotypy, or printing by sound.

On introducing this subject to the notice of the members of the Victorian Institute, I can but wish some person had the task better able to do justice to its simple yet philosophic beauty. My chief object is, that any who may feel desirous of paying attention to the matter, may have an opportunity of doing so; that a section be formed for such purpose, and thus one of the primary objects in the establishment of this Institute be brought to bear.

My observations will necessarily be brief, and of a fragmentary character; and doubtless, those here who understand the subject, will feel that much, very much, more might have been said in favour of the system. Still, I hope to make all tolerably well acquainted with the principle upon which it is proposed to reform our orthography, and perhaps excite the interest or curiosity of some to know more of it.

Phonographers have no new tale to relate. They must still reiterate the tale of their fellows for the last seventeen years; and, indeed, what hosts of great and good men before them have laboured to lay before the world. The same inconsistencies and absurdities in our orthography are manifest, and the want of some more efficient mode of communicating thought to paper is increasingly felt.

We live in an age, the chief characteristics of which, is the universal desire for advancement. Satisfied with nothing, man in his search after truth, leaves no stone unturned while a chance of discovery remains. Yet, though we live and rejoice in the light of modern science; though our hearts are warmed within us, as by means of correspondence and books, we commune with the distant loved one and the mighty dead, with pain we are reminded that in the land of our birth, England, social, joyous England, there are millions who have not this light; who are shut out by the circumstances of their birth, or the condition of society, from the chief blessing of civilized life—power to read and write.

We learn from the reports furnished by the Registrar-General, that ten out of every thirty-two men, and ten out of every twenty-two women; or, dropping the inconsiderable fraction, one man in three, and one woman in two, throughout the country are unable to write their names; we, moreover, learn that five of the sixteen millions of people in England and Wales cannot read! This is a startling fact, and any system which professes to be a remedy for an evil of such magnitude, assuredly demands the calm consideration of every man who is a lover of human progress.

Why is England thus o'ershadowed by a cloud of ignorance after the grand efforts made to educate the people during the last century? How is it, that with the united efforts of the Sunday, National, British and Foreign, and other School Societies, so little has been accomplished, considering the vast field open for their labours? We answer, it is because "it is impossible for any one to read till he has charged his memory with the pronunciation of at least ten thousand words, and has so accustomed himself to the look of each, that he can at any time recall its proper sound in spite of its spelling, which would lead him to pronounce it in some other way; and because no one can write till he has committed to memory the orthography of at least ten thousand words, so that he can at any time recall the several letters he must write for each word, in spite of the sound of such word, which would lead him to spell it in some other way!" Am I asked for proof of this assertion? It is found in every sentence of English which is spoken, written, or printed.

I would not be thought to consider the mere power to read and write, education. Far from it. A person who can read I imagine, has no greater claim to be considered educated, than one who can draw a chalk line has to be considered an artist. Reading and writing are the means of education. They are, in fact, artificial modes of hearing and speaking. It is absurd that the attainment of mere reading, the power

to hear, as it were, the instruction of books, should require years of application, consuming valuable time, which properly, should be spent in the acquisition of useful knowledge; yet, so great is the difficulty of acquiring reading, that not a sixth part of the chilrden that attend our public schools acquire the ability to read with ease and correctness; and probably one-half leave school and are absorbed into the labouring community of the country, not being able to read at all. It is indeed a pure farce to vote for national education, while the power to read and write is unattainable, as is the case with the majority, in the period they are able to command for school education.

All the difficulties experienced in learning to read, is due to the absurd and lawless use of letters in the spelling of words, for, in only one word in a thousand, do the letters point out the true pronunciation, consequently there is no way of mastering the art of reading on the usual plan, but by getting "off by heart" the thousands of words comprised in the English language.

The following graphic *exposé* of the absurdities of English orthography is from the pen of Hart, a writer of the sixteenth century, a forerunner of the present orthographic reform, who excited no little merriment in his day for offering a remedy for the evil. There are some people, in the present day, who laugh at phonetic spelling, but it is from ignorance, or an aversion to any thing in the shape of reform, and they generally fail to enlist the sympathies of thoughtful men.

"And now, the better to call to remembrance the principal parts and effect of that which hath been said, I will use this allegory, and compare the lively body of our pronunciation, which reason biddeth the writer to paint and counterfeit with letters, unto a man which would command an indiscreet painter to portray his figure, as thus; naming the man Æsop; who, coming to a painter, saith,—'Friend, I would have thee to counterfeit the quantity and quality of my body and apparel, by thy craft; so lively as those men which have even now seen me, may know (whensoever they may see it hereafter,) that the same is made to repre-

sent me unto them, as I now am.' The painter answereth,—'Sir, stand you there, and I shall do it as I used to do others, and as all the painters of this country are accustomed to do.' *Æsop:* 'How is that?' The painter answereth,—'Though you wear hose and shoes, your figure shall need none. But it shall therefore have painted other apparel, by a third more than you wear; and upon every several piece I mark and write the country's name whence it came. And because your clothes, as well the cloth as the fur and silk, are of one colour, I will make them to be better seen, of divers colours. I will also write on your forehead your father's and mother's name, that men may see of what stock you are come. Whereas in some countries painters do use to make the nose of like quantity to that in the body, we set others at the ends of them. And for making the littleness of the eyes, we make the compass of the head greater than the natural, and double the eyebrows. Then, in the place of ears, we do use to paint eyes. And last of all, I will change the middle fingers and thumbs to others' places.' *The Painter:* 'How like you this? Will it not do well?' *Æsop:* 'Yes; but I would fain know for what purpose, and the reason wherefore you would do this.'' *The Painter:* 'Because the painters of this country, for time out of mind, have used the like, and we continue therein; and because it is so commonly received as it is, no man needeth to correct it.' A good answer. Now leave we them, and I demand the maintainers of such painters of our pronunciation, if they had forty or more of such portraitures drawn, shaped, and coloured, of their aforesaid friend; and those same set upon the pillars of Paul's Church, who should be able to know (but they themselves, being daily used in naming them,) which should be for the one, and which for the other. For they should not half so well represent them as should the well-proportioned figures of so many skipping babians, apes, marmoset or monkeys, and dancing dogs or bears."

1. Diminution.

2. Superfluity for *Derivation.*

Difference.

Etymology.

Length of vowels.

For shortness of Vowels use Double Consonants.

3. Usurpation of power.

4. Misplacing.

Hart's ludicrous illustration of the portraiture of spoken languages in the sixteenth century is true in the last particular of our present representation; indeed, its state is far worse now than then, and every year its tendency to the hieroglyphic type is more apparent.

It may be well to examine for a moment the principal causes which have brought about this unsatisfactory state; it will be necessary briefly to run through the history of the art of transmitting the symbols of ideas, as well as the progress made in the art of perfecting those symbols.

In the earliest ages, when the requirements of man were comparatively few, the swiftest runners were selected to convey a message; fire signals were also used for many centuries; subsequently the rocket system, and more recently still, the semaphore; last, and greater than all, the electric telegraph. In the former contrivances the signification had to be pre-determined, and only thus far could they be made available; but with the electric telegraph no pre-arrangement is necessary; indeed, we are quite justified in thinking, that in this, at least, we have attained perfection. Certainly, we cannot conceive a quicker mode, and it is admirably free from the incumbrances which attended all former contrivances. How vast, then, have been the improvements made in the art of transmitting symbols of ideas—from the courier to the electric current!

Let us now glance for a moment at what has been done towards improving the symbols themselves.

There can be no doubt that in the remotest times the representation of language was hieroglyphic, that is, it was composed of a series of thought pictures, or, as it were, portraits of ideas. A sign was required for every distinct idea. As men thought more and pourtrayed their thoughts, so these symbols increased, until they became too numerous for the memory to retain.

It is impossible to give the exact date of the invention of the alphabetic system of writing; but we learn from history that the Egyptian priests knew both the hieroglyphic and alphabetic modes; and moreover, we learn that they kept the secrets of their caste and creed in the former because of the great difficulty of acquiring and retaining it in memory.

Nevertheless, the introduction of alphabetic writing forms no insignificant era in the world's history. The inventor happily subjected language to a careful analysis, and found it to consist of simple vocal sounds, which, though admitting of infinite combination, were, in their radical elements, surprisingly few. This discovery formed the basis of his system. These vocal utterances required only representative forms, which he doubtless selected from the numerous figures or thought-pictures he had been accustomed to write. Of course, the simplicity of the sign could not then be any object; it was sufficient that it suited admirably the requirements of the age—perfection was not to be expected.

The Phœnicians, Hellenes, and Egyptians, all used the same characters. The Greeks obtained their alphabet from the Phœnicians. The Latins adopted theirs from the Greeks. The northern conquerors of Rome took as spoil the letters of the vanquished, and, with but trifling alteration, adapted them to represent their numerous tongues. Thus, any original errors which there may have been were transmitted from nation to nation, and from generation to generation; and numerous are the defects from omissions and alterations.

The result is before us; modern English is considerably less scientific—less true to the alphabetic theory upon which it is professedly based than the ancient Phœnician.

Great as has been the progress made in the art of transmitting symbols of ideas, we cannot but note a retrograde movement in the perfecting of the symbols themselves.

Various schemes and systems have been proposed whereby to arrest the backward tendency; but they have fell far short of the mark, from their want of scientific basis.

The inventor of phonography happily reverted to the original idea of the inventor of alphabetic writing. He sought the elementary sounds and gave to them appropriate representatives. Thus its foundation is eminently scientific and simple. The phonetic alphabet contains as many marks

or signs as there are elementary sounds in the English language. In this it varies from the old Latin or Romanic alphabet hitherto used, which provides no signs for many sounds, and the letters it contains are not always used to represent the same sounds.

It will be observed that nearly all the letters of the Phonetic alphabet are arranged in pairs, one letter of each pair being represented by a light sign, the other by a corresponding heavy one. The difference between the two letters of each pair of vowels is in length or duration. There are six pure vowels,—*e, a, ah, au, o, oo,* with their light sounds, as in fit, met, bat, not, nut, and foot. Of these all other sounds in the English are compounded.—(See *Plate.*)

The difference in the letters forming each pair of consonants is, that the first is a thin or light articulation, and the second a thick or heavy one. These letters are consistently represented by thin and thick dots and strokes. Many persons, who are not acquainted with phonography, think that light and heavy strokes are not easily made in rapid writing; but the experience of thousands of persons, many of whom have written the system for years, proves that the slight difference necessary to distinguish the one from the other, is made without any perceptible effort, the heavy strokes being traced by the hand with as much facility as their corresponding heavy sounds are produced by the various organs of speech.

Such then is the Phonetic alphabet, such is the alphabet of nature, which, we believe, sooner or later, men will see necessary to adopt. The years of toil spent in teaching and acquiring the art of reading would be lessened to a few weeks, and there would be no longer a danger, as there now is, of creating a distaste and positive aversion to study. That which is now a severe task would become a source of imperishable pleasure.

In conclusion, Mr. Chairman and Gentlemen, I would remark that there are many points of interest which should

have been noticed, but which were beyond the limits of a paper of this description. It is sufficient that the system harmonises in all its parts, and from whatever point of view, it presents simplicity as its beauty, and commends itself to our notice by its beautiful adaptation to our wants. I would call particular attention to the general truths laid down in this paper, for beyond them there is but little difficulty.

Every portion of the system is so reduced to certain and easily understood principles, that the perception of one part necessarily leads to the attainment of the rest. I shall be happy to furnish any information I am able, and should any member wish to obtain works treating of phonetics, I shall be pleased to lend any I have in my possession.

XII.

ON THE TIMBER OF THE COLONY.

BY GEORGE HOLMES, ESQ.

READ MAY 3, 1855.

In the greater portion of the habitable world timber is the most valuable part of the vegetable creation; the inexhaustible supply of wood in almost every country has been made use of by mankind from the earliest period of his existence.

It may be presumed it was first used as firewood; and in the erection of huts, implements of husbandry and warfare, as may be seen in clubs, bows, arrows, boomerangs, spears, &c., &c.

Growing trees are supposed by naturalists to have the same extent of surface occupied by roots as the branches above, but this is as yet not decided.

All proper wood possesses two sets of fibres, in which the growth of the plant is perfected.

The medullar or horizontal rays radiate from the centre or pith of the tree to the outer bark; most fibres are smaller and closer as they proceed externally. Consequently more dense, from the tubes being smaller than in the inner portion.

The vertical fibres and the medullary rays are intermingled in some timbers closely and uniformly; which together form collectively the substance of the wood, with the cells running amidst the fibres.

A portion of these vessels or cells are employed in carrying food from the roots to the leaves or mouths of the plants; when digested the fluid returns through the outer cells, near the bark, and combinates with the matter in the external layers of the wood, and mostly becomes consolidated, and forms the new ring, in addition to a portion of the bark; annually, the remainder returns to the earth as excretion. The last or colouring process, is supposed to be the decomposition of gum, or resinous fluid, throughout the medullary rays, towards the centre, where it leaves its contents, forming the first ring.

The multiplicity of fibres constitute the chief difference between hard and soft wood, as also its specific gravity.

Flexibility in various woods, caused by the distances between the vertical and horizontal fibres—if long, vertically, the wood is tough; if short, the result is the reverse—the beech is an example of the latter sort.

The most elastic woods are those whose fibres are less

intermixed with horizontal rays, and free from knots, such as lancewood, hickory, ash, &c., &c.

Cross-grained timbers have the rays irregular and sometimes diagonally, such as the elm, maple, lignumvitæ, &c.

By the preceding data one is enabled to form a pretty correct idea of the value of wood, and the purposes for which each variety is best adapted.

The woods of this colony, generally belong to the harder and tougher sorts, with some exceptions.

A few of the trees most familiar to us.—The

Blue Gum . (Eucalyptus Robusta).
Stringy Bark („ Faborum.)
Flooded Gum („ Goniscalyx).
Red Gum (Cantho-carpies)

and boxwood are used for many purposes where strength, durability, and size are necessary. Red and blue gum wood are much used in ship building, and generally in public works, such as railways, bridges, piles, by coach builders and manufacturers of agricultural implements.

The stringy bark is not so valuable a timber for these works, being lighter and more liable to warp and split; still its immense size and straight grain renders it very useful where long piles are necessary, as also for trenails and a variety of other purposes.

The above timbers are a good substitute for the oak, elm, ash, and hickory of the old world.

I am not aware of any experiments as to the relative strengths of timber grown in Australia, except in one instance where iron bark is tested with English oak. The proportion is 1000: 1557, which gives a result of fifty per cent. to the iron bark, and makes it so much prized for spokes and felloes by coach builders and carpenters.

Some of these timbers are imported to Europe, but the purposes to which they are applied seems strange; for in-

stance, in making ramrods and handles for surgical instruments and artizans' tools.

These woods are valuable now, and will be still more so when the "iron horse" snorts through the primeval forest.

There is one important characteristic connected with most of the hard wood grown here, and in other countries where the hot winds rush over.

These timbers when placed in works are much more liable to contraction longitudinally than European wood, therefore it behoves engineers, architects, and builders, to make calculations accordingly. I have myself seen one-half an inch contraction in a piece of timber eight inches square by ten feet long.

Cedar (*Cedralis Australis*) is too well known to require description. Almost every block of houses in Melbourne can show to what purposes it is applied, both in the shape of furniture and in-door fittings, &c., &c.

Most of the above woods are in Europe called Botany Bay beef wood by the mechanics and men who use them.

Other colonial woods are very important, where their use becomes known to us. These woods are not of such immense growth nor so numerous as the before-mentioned.

Black Wood, (*Accasia Melunoxylin.*)

Botany Bay rosewood is a very valuable and beautiful wood; used in the manufacture of the finest furniture fittings, decorations, &c.

He Oak, (*Casurina quadrivalvis.*)

She Oak, (" *equaælifolia*), and others.

Woods of smaller dimensions, equally beautiful, being capable of receiving a fine polish, or formed in the hands of an artist to the beauteous forms by which wealth and luxury are surrounded; while at present a few specimens may be occasionally seen in the hands of a turner, and now and then in a small piece of cabinet-work.

There are other woods valuable, not yet brought into

much notice, such as the honeysuckle, (*Bunksia Australis*), and woods of the same class, which require an investigation above what is here intended. But it may be seen by reference to the Sydney Exhibition Catalogue. It is shown there are 245 varieties of native woods, collected from the southern districts. Of these—

22 produce excellent hard wood
12 " wood suitable for turning.
16 " wood of considerable variety for cabinet-making.

XIII.

MICROSCOPIC INVESTIGATION, AND SOME MINOR DETAILS OF MANIPULATION.

BY WILLIAM SYDNEY GIBBONS.

READ MAY 3, 1855.

IMPORTANT and interesting as doubtless all will admit the study of micrography to be, some apology may appear necessary for the selection of a subject so limited in its interest as that I have chosen for the present paper. The details I have to communicate are so apparently trivial, that few, but those who are engaged in the prosecution of microscopic investigation, will be likely to enter into them with me. They are merely points of manipulation—the results of my own expe-

rience, and only mentioned inasmuch as they differ from the operations of others. It frequently happens in a place like this colony, where the ordinary appliances of science are of difficult attainment, that the student has to resort to expedients varying somewhat from the routine of English and Foreign observers. It is chiefly of such expedients and of the peculiar contrivances for mounting microscopic preparations which have from time to time occurred to me that I have now to speak.

To introduce and recommend the study of Microscopy or Micrography to those who have not hitherto entered upon it, I may be allowed to make a few observations as to its value and importance, and as to the modes in which the present may be followed. As the use of the microscope and the arts of preparation are much better set forth in the valuable text-books of Quekett, Hogg, Pritchard, and others, than I can hope to do in a casual paper, I do not propose to enter at any length into general descriptions. The microscope, formerly popularly regarded only as a costly philosophical toy, and used by scientific men only for purposes of limited and perhaps questionable importance, has of late years become the inseparable companion of the investigator of almost every branch of science.

Not a single department of natural history, taking that title in its widest sense, is independent of the microscope. By its aid the geologist discovers traces of old organisms, which, without it, must have remained sealed; he employs it in his search for coal and for the estimation of its value when found. The mineralogist is frequently indebted to it for the comparison of crystals and the examination of minerals generally. Its uses to the zoologist are beyond enumeration; the structures of bones and teeth have alone sufficed to refer a fragmentary fossil to its proper position in the scale of nature; a knowledge of the varied organisms of the other animals has often served to distinguish them, when necessary,

from each other, and from those of man. The botanist would be totally at a loss without the means of examining the form and arrangement of the minuter parts of plants; he needs also to identify woods, to compare recent with fossil plants, and to determine a multitude of points that have entered in a commercial as well as scientific point of view. The chemist uses his microscope to examine the results of minute analyses, to watch changes that follow the use of re-agents, and to follow out successfully the study of crystallography and inorganic structure. In medical practice occasions for the use of the microscope are of constant occurrence; and the study of anatomy, physiology, and pathology, would be incomplete without recourse to it. The different appearances presented by portions of the animal economy under various conditions of health and disease, the indications afforded by the secretions, the fluctuating characteristics of the blood itself, and the evidences which diagnoses based on these observations will afford of the treatment and remedies which the system requires, are among the uses of the microscope to the medical man. And in cases in which a life has depended upon its decision, it has frequently been enabled to pronounce with absolute certainty upon the guilt or innocence of a prisoner charged with a capital offence. Harvey's great discovery of the circulation of the blood received conclusive support from the observations of Malpighi who first witnessed the beautiful phenomenon.

By the microscope the purity of many articles used in food and medicine, and the genuineness of textile fibres and of materials, and in the arts, may frequently be tested, and adulteration or substitution detected. The commission instituted by the *Lancet,* for the purpose of examining several articles of extensive domestic use, frequently relied entirely on the observation of form and structure. The farinæ of different plants may be distinguished by the peculiarities of the starch grains; drugs, upon the purity of which

so much of our health depends, are amenable to the same test; in short, greater difficulty would be found in selecting a subject of study in which the aid of microscopy is not valuable than in enumerating its varied applications. I have selected for the inspection of the members present a number of objects illustrative of the preceding observations, and it will be a source of great gratulation to me if I succeed in alluring to this most fascinating and useful pursuit any of my hearers.

A brief notice of the ordinary mode in which objects are prepared for observation and preservation, will serve to explain the comparatively trivial details that have suggested the writing of the present paper. It is of the first necessity that the delicate structures be securely protected from injury. This is generally effected by enclosing them between two plates of glass. The mode in which they are so mounted varies with the nature of the object, and the practice of the operator. Opaque objects are frequently mounted dry, and without covering. The best mode of mounting for these is to attach them to a dark ground on glass slips of standard size. Professor Quekett and other writers have recommended various forms of cell for this purpose; the use of small pill boxes presents the advantage of the protection which the covers afford. In the absence of these I have made a very useful cell of millboard. I punch in a sheet of millboard a series of holes of the size of the inside of the intended cell; I then paste a sheet of stout paper on one side of the sheet, and paint the whole with a pigment composed of lampblack and size, which I find of constant use: when the whole is dry I cut out the cells with a large punch.

Cells made in this way are readily and cheaply obtained, the materials are always at hand, and they answer for various kinds of objects. For those which it is intended to show by reflected light, they need no further preparation; they are simply gummed to the glass flat, and the object is attached

to the bottom by the same cement. They have also this advantage—that they may be made of any required depth, and, if desired, a certain portion of one side may be cut away to admit a greater amount of light on any one part of the object, while the general protection remains; they may also be made of any size and form that is desired. If the black pigment be made with strong size, the cells will be impervious to balsam and oily fluids, if not to spirit, and the substitution of varnish for size will qualify them for the reception of the other preservative fluids. The covers may then be attached by means of gold size or any other of the usual cements.

The use of gold size presents so many advantages that I prefer it in all cases where it is admissible. I find it advantageous to paint the rims of the cells with gold size some time before using them, and to allow them to dry; this proceeding greatly facilitates the attachment of the cover, a matter of some importance when mounting in fluid: it also very much lessens the risk of the gold size escaping into the cell. I have also made some excellent cells of gutta percha and lead, which I submit for the inspection of the meeting. I anticipate being able to make some cells on Darker's plan out of the latter material by means of dies. To make built cells and troughs I generally use Canada balsam, and employ a rather high degree of heat to give it a good hold of the glass. I have troughs made in this way that have lasted for years.

For cutting the slips of glass, or flats, as they are technically termed, I find it convenient in the absence of a cutting board (and I am not sure that it is not the better plan) to rule a sheet of paper with lines dividing the whole surface at compartments of the required size; by this plan glass of irregular form may be worked up with great exactness. While on the subject of glass cutting, which, trivial as it may appear, is of no small importance, especially as we have no Ross or Topping to go to for a gross of patent *flats* or an ounce of *thin covers* when we want them, I may be allowed

to mention a mode of cutting the covers without risk of breakage. It is simply to lay the work on a slab of plate glass, wetted. The water affords support to the fragile material, and binds it to its position, so that the operation otherwise difficult, is easily performed. I mention this not as an original idea, but because it is mentioned by but few writers, and it is possible that others may experience the same difficulty that I frequently laboured under until I met with the suggestion. Those who are not operators will see the value of even this simple artifice when they are told that the material to be cut is glass of the average thickness of a hundredth of an inch,—and unannealed.

Writers and operators are divided as to the advisability of using turpentine, as a diluent to Canada balsam, in making microscopic preparations. It is often objected, that oily globules separate themselves from the turpentine after a few weeks. I cannot say that I have found this difficulty; some of the preparations now on the table have been made for three or four years, with turpentine in equal proportion to the balsam, and they are yet clear and perfect. I frequently keep a mixture of balsam and turpentine ready for mounting; it requires a gentle continued heat to evaporate the volatile matter, but I am of opinion that the preparation is more permanent and less likely to split away on receiving a jar, than when balsam alone is used. In the latter case, I always touch the heated balsam on the flat with a single drop of turpentine, to clear it of bubbles before placing the object. Sometimes I have used the previously noticed dilute balsam cold to mount the object, and have sealed it by the application of heat after the cover has been put on. For objects in which it is desirable to retain the air, as the tracheæ of insects, and indeed, in injected pulmonary organs generally, it is advisable to compress the object by the aid of water or spirit, and to let it dry. The balsam should then be heated, and allowed to become slightly cool, and the object laid upon it and immediately covered, the cover being warmed. The tracheæ of a musquito,

now on the table, was mounted in that way. Several of the scales and wings were mounted on dilute balsam, as above described. I have found the wooden clips, imported under the unpretending title of American spring clothes-pegs, invaluable as compressors, both for flattening objects and for compressing them when mounted, so as to bring the covers fairly down upon the object, and to ensure perfect union between the glasses. The clips are also useful in building cells, and in a multitude of other operations; used in pairs one at each end of a pair of flats, they serve to replace the ordinary compressors for temporary observations.

Some years since I made some experiments in the use of the air-pump in making microscopic preparations, believing that it had not then attracted the attention of operators. Since that time, I found in a recent work an account of some uses that had been made of that instrument, but that which I found most advantageous was not mentioned and appeared to have escaped the experimenter; while that most dwelt upon in the work in question, is one that I abandoned as unavailing, nor have I seen occasion to change the opinion. The operator quoted immerses the objects in balsam, and then places them on a dry hot bath under the receiver of an air pump; the air is supposed to be extracted by this process from the minute pores or cells, and its place supplied by the balsam. I found, however, that in the majority of cases the viscidity of the balsam retains the bubbles of air even when they escape from the object, and that many of them return to their original positions on the restoration of atmospheric pressure. The plan I recommend as preferable, is to immerse the object in a bath of turpentine, and exhaust it before applying the balsam. The limpidity of the turpentine allows the free escape of air, and when the object is removed from the bath to be mounted, the balsam then blends with the turpentine, and follows it into minute cavities whither it could not alone have penetrated.

Before quitting the subject of mounting, I may mention that I have found the common balsam of copaiba a useful

medium in which to preserve objects of a delicate character, which it is not desired to mount immediately. I have used it cold, and have mounted the objects in it temporarily, between two plates of glass; and have transmitted them by post and otherwise to distant parts of the country in perfect safety; objects so prepared may at once be mounted in Canada balsam without further preparation. The advantage derived from the use of copaiba is that it is not so viscid, and does not dry so rapidly as the other balsam, while its refracting properties are so little inferior that no detriment results from its use.

The next point on which I have to make an observation that I believe to be original, is the mode of killing insects and other small animals. A paper recently read to the British Association mentions that cyanide of potassium has been employed for this purpose. I have had occasion to make some rather large quantities of this salt for other processes, and contemplated the employment of it as a means of destruction, for which its active poisonous property eventually fits it, but I was so well satisfied with other plans, that I have not yet tried it. I find that immersion in turpentine kills small insects almost instantaneously, and has the great advantage of making them protrude their probosces, lancets, and other organs—a very desirable effect; they are also more readily saturated and rendered diaphanous than after they have been allowed to harden. If it is intended to disect the internal organs, this plan will not do, and Swammerdam's plan of suffocating the animals in spirits will be found almost as rapid, and much more suitable. But the agent I most incline to in cases when turpentine is inadmissible, both on the ground of humanity, as causing speedy death, and for its preservative quality which renders it suitable for the cabinet, is creasote. If the mouth and spiracles be touched with a pencil dipped in it, the creatures most tenacious of life, soon yield to its influence. The use of spirit to suffocate the animal, and the exhibition of creasote to its mouth,

&c., both present the advantage of hardening the viscera, which is very desirable, as it tends materially to assist the process of dissection—at least so long as the albuminous portions are not so much coagulated as to make the delicate organs cling together. There is risk, however, that cyanide of potassium would corrode delicate organisms, and thus be productive of mischief. Small soft-bodied animals are, by soaking in spirit, rendered less liable to injury in the process of compression.

For the purpose of collecting aquatic animalcules, I use, in preference to any kind of net, those on the table. They consist of stout tin hoops, about four inches diameter and one and a half deep, nested for stowage. Muslin of different degrees of fineness is strained over one opening of the hoop, and a screw is attached by its head to the rim. The net is thus portable, and is screwed into a hole in the end of a walking-stick, or what is better a fishing-rod. I find that for most purposes the fabric called bobbinet answers very well, and catches creatures much smaller than its own meshes, while the free escape of water through the openings prevents their being washed out, as they frequently are in withdrawing the net from the surface. If the stick have a spike at the other end it may be stuck in the ground, and those animals that are visible to the naked eye leisurely picked out, with a small thin spoon or palette-knife, and transferred to bottles, care being taken that the more voracious ones be separated from their prey; while the thick residuum, containing infusoria, &c., may be ladled up or strained off into its appropriate vessel. On arriving home the contents of the bottles are poured into one of the finer nets, which is placed in a saucer of water. The drafting net is then lifted up out of the water, and a final classification may be made. To catch individual creatures that are too large for a fishing-tube, a small spoon-net, made of slips of thin metal, bent into the form of a spoon, with a large hole punched out of the bowl, and muslin cemented to the rim, will be found convenient.

This form of net is free from the inconvenience of loose parts of material, in which choice specimens may be confused and lost.

Before concluding this paper, I may mention a very useful cement, for fine work, which was communicated to me by my friend Mr. Capewell, of Ballan. Canada balsam is heated and evaporated to dryness, and the residual resin dissolved in ether. This cement dries as rapidly as collodion, is perfectly limpid, and does not coagulate.

I hope soon to submit to the Institute a section cutting machine, which I am constructing on a plan different to any I have yet met with, and presenting, as I fancy, some conveniences. I have here some sections cut with it in its present state, but it is not yet mounted.

Whatever value may be attached to the observations I have here made, and to the new modes of operation that I have recommended, I offer them in the hope that other observers will similarly favour us with the result of their experience. Many of the contrivances mentioned were devised long since in the absence of other appliances, and when text-books were scarce here, and there were few collaborateurs within my acquaintance whom I could consult. Thrown thus upon my own resources, I had to contend with many rough substitutes, the inconvenience of which compelled the invention of some more suitable contrivances. Those who are engaged in similar pursuits will readily enter into these observations, and will, I trust in like manner, communicate information as to their modes of action, as by entering into these particular details, results of general importance are attained. To such persons no apology will be necessary for the matter of these notes, whatever defects there may be in the manner, and I hope that those to whom the minute and apparently trivial details were dull and dry, will find subjects of interest in the resulting specimens which I have the pleasure to submit to them.

XIV.

DESCRIPTION OF NEW AUSTRALIAN PLANTS CHIEFLY FROM THE COLONY OF VICTORIA.

BY DR. FERD. MUELLER,

GOVERNMENT BOTANIST.

[SECOND SERIES.]

READ JUNE 7, 1855.

Cruciferæ.

1. *Cardamine eustylis.*

Dwarf, glabrous or somewhat downy; root creeping; stem thin, upwards naked; leaves petiolate, pinnatisected; segments five to seven, ovate or oblong, lobulate or with a few teeth, the terminal one the largest, the inferior ones narrowed into the base; pedicels at length remote, spreading; petals shorter than the calyx; style longer than the diameter of the spreading silique.

On moist sandy places on the Murray River in South Australia.

Not unlike C. sarmentosa.

2. *Sisymbrium trisectum.*

(Sect. Arabidopsis.)

Suffruticose, glabrous, erect; leaves glaucous, divided into three linear-filiform segments; pedicels thread-like, three or

four times shorter than the silique, slightly spreading; style very short or wanting; stigma dilated.

In the desert on the Murray River, on Spencer's and St. Vincent's Gulf, and near Lake Torrens.

Besides this and the following species, the genus contains two others already known from Australia, namely S. filifolium and S. nasturtioides, both referred formerly (Linnean, xxv. p. 368) to Erysimum.

Malvaceæ.

Greevesia.

Calyx closed, at full maturity of the fruit expanding into five segments, surrounded by five shorter lanceolate spreading bracteoles. Petals five, much shorter than the calyx, twisted, never expanded, adnate to the tube of the stamens, and concealed by the calyx. Anthers five, ovate-kidneyshaped, one-celled. Pollen-grains oblique ovate-spherical, echinulate. Styles ten, dilated into convex at length penicillate stigmas. Carpidia five, perfectly free, net-veined, indehiscent, one-seeded, oblique ovate, slightly keeled. Seeds kidney-shaped, smooth, filling the cell.

This highly remarkable genus, which has been dedicated to Dr. Aug. Greeves, one of our warmest supporters of science, is as well from Pavonia, to which it ranks next, as from all other genera of this order, well distinguished by its extraordinary character of covering with its perfectly connate sepals the little twisted corolla, which therefore does not see daylight until shrivelled up long after fecundation, when at length the calyx unfolds to eject the ripe carpels.

3. *Greevesia cleisocalyx.*

Discovered in eastern tropical Australia during Dr. Leichhardt's exploring expedition by Mr. D. Bunce, and now cultivated in the Botanic Garden of Melbourne.

A small shrub, with oblong- or ovate-cordate crenate leaves, which are underneath covered with a grey toment. Peduncles axillary, solitary. Petals ovate-oblong, red.

Howittia.

Calyx five-cleft, without an involucre, shorter than the petals. Stamens numerous, all separately emerging from the tube. Anthers kidney-shaped, one-celled. Grains of the pollen globose, scabrous. Styles three, connate into one. Stigma club-shaped, three-lobed. Capsule sessile, depressed, with three valves and three cells; valves bearing the septum in the middle; cells two-seeded, including at the top a slight quantity of woolly hair. Axis of the capsule persistent, thread-like, Seeds obovate—three-sided.

This new malvaceous genus, which bears, in acknowledgement of his devotion to botany, Dr. Godfrey Howitt's name, is nearest related to Lagunaea, less to Fugosia.

4. *Howittia trilocularis.*

On bushy declivities around Lake King.

A flexil shrub, attaining the height of twenty feet. Leaves ovate or oblong—lanceolate,with a heart-shaped base, above scabrous, beneath tomentose. Stipules never distinctly developed. Peduncles axillary, solitary, filiform, single-flowered. Petals obovate purplish.

DIOSMEÆ.

5. *Asterolasia chorilœnoides.*

Much branched; leaves very spreading, sessile, coriaceous, with revolute margin, terete-linear, above smooth, beneath velutinous; flowers small, capitate, furnished with bracteoles; sepals glabrous, of equal length with the carpels; petals wanting; filaments below the middle villose; style glabrous; stigma minute, undivided; seeds opaque, tuberculate.

On dry coast-ridges near Lake Hamilton in South Australia. C. Wilhelmi.

Anomalous in producing bracts and a simple stigma, yet not to be separated from the two other species; offering thus a close approach of this genus to Chorilæna.

Sapindacaæ.

6. *Dodonæa hexandra.*

Erect, glandular—scabrous; branchlets thin, indistinctly angulate; leaves sessile, filiform-linear, acutish, not furrowed, on the margin revolute; flowers dioecious, hexandrous, axillary and terminal, all solitary on short pedicels, nearly drooping; sepals three, ovate—lanceolate, acuminate, filaments very short; connective of the anthers puberulous at the top; capsules depressed, with three rarely four valves, which are wingless, but bear an appendage on the back; seeds shining.

In the scrub near Port Lincoln, on limestone. C. Wilhelmi.

Undoubtedly similar to D. pinifolia.

Polygaleæ.

7. *Polygala veronicea.*

(Sect. Polygalon.)

Stems suffruticose at the base, erect or diffused, nearly terete, hardly branched, as well as the peduncles and pedicels puberulous; leaves alternate, close to each other, soon smooth, the lower ones ovate or round, the upper ones lanceolate, acute, apiculate, net-veined, on very short petioles and with slightly recurved margin; racemes lateral and terminal, few-flowered; middle bracteole ovate-lanceolate, longer than the lateral ones, but much shorter than the pedicel; exterior sepals spreading, the interior ones ovate, contracted into a cuneate base, blunt, apiculate, glabrous, veined, of the length of the crested keel and likewise of the roundish-obcordate broad-winged glabrous capsule; ovary tapering into a very short stalk; seeds ovate, sparingly hairy, of twice the length of the strophiole.

In grassy or gravelly places from the King River to the Goulburn River.

Principally allied to P. conücarpa and P. Loureirii, both from the Chinese Empire.

It is remarkable, although already forty years ago the occurrence of the genus Polygala, within and beyond the tropics of Australia, was noticed by R. Brown, in the appendix to Flinders' Voyage, p. 544, that until now, no Australian species should have been described.

LEGUMINOSÆ.

8. *Daviesia egena.*

Tall, much branched, leafless; branches terete, erect, furrowed, unarmed; racemes very long, terminal; pedicels thickly, solitary or twin, shorter than the calyx, furnished at the top with two bracteoles; which are rounded, persistent, ciliolate, connate at the base and larger than the lower ones; calyx indistinctly angulate, with acute teeths, the lowest of them longest; keel perfectly blunt, hardly longer than the wings; stamens all connate; ovary subsessile and style smooth; pods oblique oblong-ovate, slightly convex, with a very short beak; seeds equally brown, with a papillous irregular lobed strophiole.

In the barren bushy plains along Spencer's Gulf, Lake Torrens, the Flinders' Ranges, and Murray River.

The bibracteolate calyx distinguishes this strange plant from the rest of the Daviesia species.

9. *Eutaxia sparsifolia.*

Branchlets spreading, as well as the calyces silky; leaves dispersed, short-stalked, semiterete-trigonous, channelled, glabrous, acutish, slightly recurved, spreading, at last deflexed; flowers a few together on the top of the branchlets, stalked, without bracteoles; upperlip of the calyx rounded, a little emarginate; teeths of the lower lip deltoid-acuminate; pods turgid.

In the desert scrub towards the mouth of the Murray River. Found also at Tumbay Bay by Mr. C. Wilhelmi.

10. *Pultenaea fuscata.*

Branchlets hardly spreading; leaves stalked, trigonous linear, channelled by the inflexed margin, acute, mucronulate, the uppermost below the middle long ciliated, the rest smooth; stipules large, concrete, imbricate, setaceous-acuminate, fringed; heads few-flowered; teeths of the calyx and bracteoles setaceous-acuminate, downy; ovary sessile, silky.

Between the Coorong and Murray River, on scrubby localities.

Next to P. arista.

11. *Pultenaea canaliculata.*

Branchlets hardly spreading, velvety; leaves oblong-linear, blunt, very short-stalked, channelled, gradually tapering into the base, somewhat silky-velvety; stipules lanceolate or linear-subulate, downy; heads few-flowered; calyces downy, pale, membranous, little longer than the downy linear-setaceous bracteoles; teeth of the upper-lip broader, all setaceous-acuminate; ovary sessile, velvety; pod beaked; seeds somewhat shining.

At Encounter Bay.

Near to P. mollis.

12. *Pultenaea densifolia.*

Branchlets divaricate, leaves small, crowded, coriaceous, broad-obovate, or somewhat cuneate, stalked, glabrous, mucronulate, rarely blunt, recurved, above shining, beneath veined, their margin flat, sometimes with a few hairs; stipules imbricate, nearly lanceolate, membranous, pale brown, fringed; flowers axillary, solitary, or in terminal heads; calyces membranous, little longer than the fringed lanceolate mucronulate bracteoles, with the exception of the mar-

gin smooth, their teeth nearly equal, setaceous-acuminate; pods oblique ovate, turgid, slightly silky, sessile.

In the lower Murray desert.

Also near Port Lincoln, according to C. Wilhelmi.

It stands in relation to P. parviflora.

13. *Cassia revoluta.*

(Sect. Chamaesenna.)

Shrubby; leaves with a channelled rachis, and with six to ten pairs of leaflets, which are lanceolate-linear, pointed, above smooth, beneath and along the revolute margin hairy; a subulate gland between each pair; stipules linear-subulate; bracteoles cymbiform-ovate; peduncles axillary, about as long as the leaves, with from two to four umbellate flowers, together with the branches, pedicels, and rachis pubescent; sepals ovate, glabrous, ciliate, the outer ones broader; one petal much shorter than the rest, nearly round; legume stalked, smooth, slightly arched.

On gravelly, sometimes overflown places, along the Avon, in Gipps' Land.

The systematic position of this Cassia will be between C. Australis and Schultesii.

Rhamnaceæ.

14. *Trymalium phlebophyllum.*

Branchlets thinly clothed with velvet hair; leaves coriaceous, oval or roundish-ovate, blunt or retuse, above perfectly glabrous and densely net-veined; beneath grey-silky, their margin generally reflexed; stipules lanceolate, acuminate; glomerules disposed in cymes, tomentose; carpels indehiscent.

On the rocky summits of the Elders Ranges and other mountains near Lake Torrens.

Easily recognised by the numerous prominent anastomosing veins of the leaves.

Length of the leaves, quarter to half an inch.

15. *Trymalium bilobatum.*

Branchlets subvelutinous; leaves herbaceous, wedge-shaped, with a dilated bilobed summit, with flat or revolute margin; above glabrous, beneath very thin velvety; their lobes truncate, denticulate, the notch apiculate; stipules lanceolate-subulate; umbels somewhat velvety; crowded at the summit of the branches; style, three-cleft; carpels bursting at the base.

On dry scrubby ridges towards Guichen Bay, and on Spencer's Gulf.

A remarkable plant; in the form of the leaves not dissimilar to T. bifidum; in the arrangement of the flowers and fruits, however, resembling Pomaderris eliptica.

16. *Trymalium bifidum.*

Branchlets velutino-tomentose; leaves nearly herbaceous, linear-cuneate, forked, with revolute entire margin; above scantily, beneath densely silky-tomentose or above glabrous, the notch not apiculate; stipules almost lanceolate; flowers in dense glomerules, together with the floral leaves pale-grey tomentose; petals entire; style short, undivided.

In the Marble Ranges and on the coast of Spencer's Gulf, at Boston Point. C. Wilhelmi.

It may possibly be a variety of the following species:—

17. *Trymalium halmaturinum.*

Branchlets tomentose; leaves herbaceous, wedge-shaped or ovate-truncate, retuse or bilobed, with flat or recurved margin, above thinly clothed with a partially starry toment, beneath densely tomentose; floral leaves nearly round or ovate, entire or bilobed, above as well as the flowers pale grey tomentose; stipules ovate-lanceolate; flowers in dense glomerules; petals entire; style simple.

On sandy ridges of Kangaroo Island and Encounter Bay.

18. *Trymalium spathulatum.*

Branchlets silky; leaves nearly coriaceous, obovate-spathulate, gradually tapering into the base, almost sessile, with slightly reflexed margin, rounded or truncate at the summit; terminated by a short reflexed point; those of the branches above perfectly glabrous and even, beneath yellowish-grey silky; floral leaves above grey velutinous; stipules lanceolate or linear-subulate; glomerules disposed in a dense panicle; when fruit-bearing clammy; petals entire; style short, undivided; carpels indehiscent.

On the stony ranges near Mount Lofty, in South Australia, and in Kangaroo Island.

Trymalium obovatum (Hook. comp. bot. mag., p. 227) differs from this in distinctly petiolate leaves, which are beneath clothed with a velvet indument, and in larger flowers.

19. *Trymalium subochreatum.*

Branchlets velutinous; leaves nearly coriaceous, oblong-linear, almost blunt, with revolute margin; above scabrous or scantily velutinous; beneath densely velvety; stipules lanceolate-ovate, large; flowers cymose-glomerate, with roundish bracts; calyces, outside grey-velvety, tomentose at the base; petals entire; style simple, short; stigma trilobed.

In the desert-scrub on the Murray River.

Allied to T. augustifolium (Reissek in pl. Preiss II., p. 284.)

MYRTACEÆ.

20. *Verticordia Wilhelmii.*

(Sect. Euverticordia.)

Quite smooth; leaves crowded, linear-semiterete, at last triquetrous, very short mucronate; corymbs terminal, compound; bracteoles distinct, without ribs, awnless, caducous; tube of the calyx ovate-bell-shaped; lobes of the limb with

from three to five capillar naked simple segments; petals glabrous, perfectly entire; sterile stamens extremely minute, linear-subulate, glabrous, undivided; style exserted, nearly straight, bearded at the extremity.

On limestone ridges at Boston Point. C. Wilhelmi.

This exceedingly pretty little bush forms one of the systematic links between the flora of South and Western Australia. It is accompanied by Myoporum parvifolium. Dodonaœ humilis, Phyllanthus cygnorum, Templetonia retusa, and other Western Australian plants, but appears to be the only species of this charming and numerous genus which reaches so far east. The simple lobes of the calyx distinguish it at once from all others, except V. Lehmanni, habrantha and umbellata, and these belong to a different section of the genus.

21. *Camphoromyrtus pluriflora.*

Leaves spreading, lanceolate-linear or oblong-lanceolate, acutish, awnless, with flat perfectly entire margin; peduncles generally three-flowered.

On the banks of the Tambo, on the Snowy River, and on several of its tributaries.

22. *Camphoromyrtus crenulata.*

Leaves spreading, ovate or obovate-oblong, blunt, with flat densely and unequally crenulated margin, peduncles one to three-flowered.

On springs and rivulets of the Buffalo Ranges.

23. *Kunzea ericifolia.*

Diffuse or procumbent, pubescent; leaves densely crowded, semiterete, blunt, canaliculate by the inflexed concrete margins, above densely hairy, beneath more or less glabrous; flowers yellow, a few in a head or solitary, axillary, sessile;

bracts and bracteoles persistent, lanceolate, acuminate, ciliated, nearly as long as the pubescent tube of the calyx; petals a little longer than the deltoid-acuminate segments of the calyx, hardly half as long as the stamens; capsule with two or three cells; seeds somewhat reticulate.

In the highest rocky parts of the Australian Alps from Mount Wellington to the Munyang Mountains.

Next to Kunzea vestista.

24. *Kunzea pomifera.*

Procumbent; branchlets glabrous or with the calyces velvety; leaves crowded, spreading, coriaceous, imperforated, either cordate or ovate-roundish or lanceolate-ovate, terminated in a recurved short point, glabrous or puberulous, indistinctly five-nerved, veined, with flat scabrous margin; flowers few in a head, terminal, white; bracts roundish; bracteoles broad-ovate, all velvety on the back, shorter than the calyx-tube; filaments long exserted; petals nearly twice as long as the deltoid segments of the calyx; fruit nearly globose somewhat baccate, slightly downy, with three cells; ripe seeds perfectly even, shining.

On the sandy shores and on rocks at St. Vincent's Gulf and Rivoli Bay.

The fleshy fruit is edible and called native apple by the South Australian Colonists.

The plant is in some degree allied to Kunzea recurva and R. Schaueri.

25. *Kunzea peduncularis.*

Erect, glabrous or rarely downy; leaves crowded, coriaceous, perforated by oil-glands, linear or oblong-lanceolate, acute, one-nerved; flowers white, axillary, solitary, stalked, crowded below the summit of the branches or forming terminal corymbs; bracts downy, lanceolate-linear, deciduous;

petals twice as long as the deltoid segments of the calyx, and half as long as the stamens; capsule with three, four or five cells, immersed in the dry campanulate calyx; ripe seeds hardly shining, reticulate.

At the foot of the Australian Alps, on the banks of rivers and rivulets.

Leaves and flowers similar to those of K. corifolia; fruit smaller and nearly campanulate; its stalk sometimes of thrice the length of the calyx.

26. *Leptospermum brevipes.*

Branchlets glabrous, or in a young state somewhat silky; leaves flat, oblong-lanceolate, very short pointed, glabrous, three-nerved, full of oil dots; flowers solitary or twin, axillary or on very short branchlets, terminal; pedicels and calyces grey silky-pubescent, the former as long or longer than the latter; lobes of the calyx pubescent, persistent, lanceolate; capsule depressed, five-celled.

Generally a companion of Kunzea peduncularis, to which it bears more resemblance in habit than to any of its congeners, being quite anomalous in producing very conspicuous flower stalks. It ranks nearest to L. divaricatum.

Haloragæ.

27. *Pelonastes tillaeacea.*

Leaves short, somewhat blunt, as well as the sepals entire; flowers all sessile, the male ones with four stamens; carpels minutely and scantily verrucose.

In wet localities of the Emu Flat, near St. Vincent's Gulf.

28. *Haloragis acutangula.*

(Sect. Cercodia.)

Stem perennial, erect, angular, branched; leaves scattered or sometimes opposite, lanceolate-linear, flat, beyond the

middle furnished with linear-subulate remote serraturæ, on the margin denticulate; asperous, on both sides glabrous, but like the stem slightly asperous; floral leaves entire; flowers hermaphrodite, with eight stamens and four stigmas, generally sessile in the axils of the upper leaves, solitary or glomerate, thus forming a long foliate spike; laciniae of the calyx cordate-deltoid, acuminate, of less than half the length of the glabrous petals; fruit large, acute-quadrangular, glabrous and smooth, with four cells, the angles keeled.

On ridges about Port Lincoln. C. Wilhelmi.

It agrees best in its characters with Hal. racemosa (Labill. Nov. Holl. I. p. 100, t. 128).

Umbellferæ.

29. *Hydrocotyle geranifolia.*

Subglabrous; stems long, diffused, laxe, partially rooting; leaves three to five-parted, the lower ones peltate; segments of all divaricate, ovate or linear-lanceolate, grossly and unequally serrate or lobed, gradually narrowed into the apex, cuneate at the base; stipules membranaceous, fringed; petioles shorter than the threadlike sometimes divided peduncles; umbels many-flowered; pedicels capillary, much longer than the flowers; fruits kidney-shaped; didymous, compressed; mericarps winged at the back, with a rib on each side, and a semicordate excavation at the commissura.

In moist valleys of Mount Disappointment, of the Dandenong Ranges, and thence to the western part of Gipps' Land.

It requires its systematic position near H. quinqueloba.

30. *Hydrocotyle pterocarpa.*

Subglabrous; stems creeping; leaves orbicular-reniform, indistinctly five to seven lobed, crenulate-repand; stipules broad, membranaceous, not fringed; petioles longer than the downy solitary peduncle; umbels generally many-flowered,

nearly capitate; fruits didymo-obcordate, much compressed, broad-winged, even; with a rib on each side of the mericarps.

From Mount Disappointment to the Ovens River, on rivulets.

Sometimes viviparous.

Allied both to H. peduncularis and plebeja.

31. *Dimetopia eriocarpa.*

(Sect. Eriosciadium.)

Dwarf, downy; leaflets of the involucre as long as the rays of the fruit-bearing umbel, narrow lanceolate or linear; mericarps equal to each other, on either side rugulose and covered all over with a thick white woolly toment.

On barren stony ridges near Cudnaka, in the neighbourhood of Lake Torrens.

Rubiacae.

32. *Galium geminifolium..*

(Sect. Leiaparine.)

Somewhat scabrous, otherwise smooth; stems long, flaccid, decumbent, with dichotomous branches; leaves remote, linear, acutish, one-nerved, reflexed on the margin, rarely four developed in a whorl, generally two of them wanting or reduced to a teeth-shaped stipule; flowers hermaphrodite, panicled; peduncles straight, divaricate, solitary, twin or several together; pedicels very short; lobes of the small yellowish corolla lanceolate; ovate, much longer than the stamens; fruits glabrous, densely dotted.

Along the margin of the Murray and Avoca.

This insignificant herb may be considered a valuable acquisition to the botanical system, inasmuch as it furnishes means of ascertaining the true nature of the stipular leaves in Stellatæ, proving apparently that this tribe cannot be separated by natural characters from the Rubinaceous order.

33. *Diodia reptans.*

(Sect. Eudiodia.)

Perennial, herbaceous, much branched; stems rooting; leaves ovate, acutish, petiolate, glabrous or covered with short stiff hair, always ciliate; stipular, vagina, truncate, with or without short bristles; flowers axillary and terminal, solitary, on very short peduncles, not opposite to each other; tube of the corolla very thin, much longer than the bidentate limb of the calyx; stamens and style exserted; the latter nearly to base divided, its divisions capillary; fruits ovate, tapering into the base, nearly glabrous, crowned by the twice or three times shorter deltoid acuminate ciliate nearly erect teeth of the calyx.

On mountain pastures, as well as on the plains along the Snowy River.

One of the most southern localities of a tribe of plants which abounds within the tropics. Nertera depressa shares its localities.

Its nearest related congener seems to be Diodia Virginia.

Loranthaceæ.

34. *Loranthus canus.*

(Sect. Dendropthoe.)

Squarrose, grey-lepidote; branchlets below terete; leaves alternate, petiolate, long-lanceolate, more or less falcate, nearly blunt, generally three-nerved; indistinctly veined; cymes axillary, with only two branchlets, bearing each three flowers; flowers pentamerous, outward grey-lepidote, the intermediate one sessile, with an oblong bracteole; the lateral ones on a short and thick pedicel with a roundish navicular bracteole; calyx five-toothed, as well as the bracteoles ciliolate; anthers linear, affixed with the base; style filiform; berries urceolate-ovate, greyish-yellow, succulent.

Along the Mackenzie Creek at the Grampians, on the Buffalo Creek, and the Upper Ovens, parasitical on Acacia mollissima; at either of these localities rare.

I regret not having been able to examine well developed flowers of this plant. The leaves are not unlike those of L. pendulus (L. Miquelii Lehm) and L. eucalyptoides. The fruits offer very decisive marks of distinction amongst the numerous species; thus they are in L. canus more succulent, shorter, and with a less contracted border, and not of a greenish-brown colour as L. pendulus. In L. Preissii the berries are pink, spherical, and of the size of a pea; in L. Exocarpi black, large, ovate; in L. eucalyptoides oblong, pear-shaped, green, with a yellowish top. All the described species require a careful new disquisition, as they are not only parasites of various plants similar to each other, but also of genera of very different natural orders. Thus L. eucalyptoides produces as long as it adheres to eucalypti or casuarinae, or now also to virgilia capensis, long falcate leaves, which, when the plant receives its nourishment from banksia integrifolia assume an ovate-orbicular shape, and a very fleshy consistence, whilst the flowers become sessile.

On a former occasion, I alluded to the singular circumstance that the genus should be foreign to Tasmania; although it is here not only amply represented, but also reaches the shores of Wilson's Promontory, and exists in New Zealand.

Compositæ.

35. *Calotis glandulosa.*

(Sect. Eucalotis.)

Pubescent from gland-bearing hair; rhizome divided, somewhat woody; stems numerous, procumbent or adscendant, leafless at the summit; leaves obovate or oblong-cuneate, the uppermost sessile, the rest tapering into a petiole, beyond the middle toothed or lanciniate; scales of the involucre ovate-

lanceolate, glandulous-pubescent; achenes ovate-cuneate, very strongly compressed, deep brown, glabrous, asperous, with a thin margin; awns four-seven, setaceous, unequal in length, at the apex retro-aculeate, scabrid at the base, alternating with an equal number of oblong or obovate-cuneate scales, which are ciliate at the top.

On dry grassy ridges near the Snowy River and its tributaries, towards Maneroo. The color of the ray is blue, like in C. cuneifolia, lasiocarpa and dentex.

This character is not without importance for distinguishing the various species. Thus produce C. dilatata, anthemoides, scapigera, and scabiosifolia whitish radial flowers, C. microphylla, Muellerii, multiseta-erinacea and lappulacea yellow ones. Those of C. (Cheiroloma), his pidula, cymbacantha and breviseta are yet to be observed.

The genus Cheiroloma may be referred as a fifth section to this genus.

36. *Chrysocoryne tenella.*

(Sect. Bisquama.)

Dwarf; leaves thick, linear, upwards broader; glomerules short, cylindrical, blunt, golden-yellow; heads with two flowers; scales of the involucre two, glabrous, naked or but imperfectly ciliolate; corolla three-toothed, short exserted.

In flats subject to inundations by winter rains, between the Long Lake and the Fountain, on Spencer's Gulf. C. Wilhelmi.

An Olax (O. obcordata), which grows conjointly with this plant, offers a similar approach to O. phyllanthi from Western Australia, as this Chrysocoryne to C. pusilla.

RUTIDOSIS.

Candolle.

(Sect. Blepharopholis.)

Scales of the involucre, neither wrinkled nor fringed. Flowers heterogamous, a few female ones peripherical, with

a three-toothed corolla. Scales of the pappus numerous, fringed.

37. *Rutidosis leiolepis.*

Stems numerous, dwarf, simple, adscending, tomentose, rising from a woody rhizome; leaves broad-linear, with revolute margin, at last smooth, the radical ones crowded with a woolly clasping petiole; flower-heads terminal, solitary, hemispherical; scales of the involucre in several rows, pale, smooth; the outer ones broad-ovate, blunt; the inner ones lanceolate; achenes oblong-ovate, truncate; scales of the pappus eleven to thirteen, oblong-spathulate.

On rocks along the Snowy River, and near it on the bare mountainous pastures.

The sub-genus established on this plant connects Rutidochlamys closely with Rutidosis.

STYLIDEÆ.

38. *Stylidium soboliferum.*

(Sect. Tolypangium.)

Soboles numerous, threadlike; leaves all radical, crowded together in a dense globule, nearly terete, glabrous, bearing a terminal hair; interstinct scales wanting; racemes few-flowered, corymbose or panicled, together with the scape glandulously pilose; calyx five-parted; lip with appendages; faux of the corolla naked.

In sandy stony declivities of the Grampians, the Serra and the Victoria Ranges.

An elegant little plant, quite of the habit of a saxifraga. It is nearest related to Styl. piliferum, and in some degree also to S. saxifragoides and S. assimile.

OLEINEÆ.

39. *Notelæa venosa.*

Arborescent; branchlets nearly terete, glabrous; leaves

large, opaque, ovate or elongate-lanceolate, acuminate, gradually narrowed into the petiole, on both sides perfectly smooth and net-veined, not or indistinctly dotted with entire or imperfectly repand margin; racemes axillary or lateral, when flowering at least three times shorter than the leaves; teeth of the calyx unequal; stigma subsessile, bifid; drupes large ovate.

In woods of the eastern part of Gipps' Land.

It shows affinity as well to N. laurifolia from New Zealand, as to N. reticulata from eastern sub-tropical Australia.

Proteaceæ.

40. *Grevillea Miqueliana.*

(Sect. Lissostylis.)

Erect; branches terete; leaves large, sub-coriaceous, petiolate, lanceolate or oblong-ovate, entire, on the margin hardly recurved, above dotted-scabrous; beneath as well as the branches and rachis tomentose; pubescent, penninerved and net-veined; racemes short, dense, many-flowered, pedunculate, drooping with centripetal development; flowers after the anthesis reclinate; calyx four or five times longer than the pedicel, red, externally grey-downy, inside below the middle white-bearded; style exserted, towards the summit puberulous, at last smooth; germen stalked, glabrous; stigma sublateral, ovate, a little umbonate; follicle oblique ovate.

On the crest of the sterile wooded ranges near Mount McMillan, and along the upper valleys of the Avon in Gipps' Land.

This rare and decorous species has been dedicated to the illustrious botanist Miquel, who, as he participates in the labours to elucidate the Australian plants, is so well entitled to this distinction.

Salsolaceæ.

41. *Blitum atriplicinum.*

(Sect. Orthosporum.)

Stems numerous, prostrate, simple, hardly streaked; leaves grey, green on both sides, alternate, petiolate, much spreading, hastate- or ovate-lanceolate, the upper ones narrow-lanceolate, all acute, tapering into the base, glabrous, with evanescent papillæ; flowers densely glomerate; fruit-bearing calyx wingless, not baccate, imperfectly closed; lobes near the base gibbous; seeds hardly keeled with a densely papillose pericarp.

In saline plains on the rivers Murray and Darling, as also towards Lake Torrens.

42. *Anisacantha kentropsidea.*

Diffuse, much branched, all over villose-tomentose; leaves nearly flat, linear, acute; calyx tomentose, short, above the middle aristate; awns two, short, thin, nearly equal.

In the Murray and Darling Desert.

It resembles Kentropsis diacantha.

43. *Anisacantha bicuspis.*

Much branched; leaves crowded, trigono-semiterete, acute, glabrous; calyx villose-pubescent, long, below the middle aristate; stamens five; anthers exserted; awns two, somewhat unequal.

In saline plains in the neighbourhood of Lake Torrens.

44. *Anisacantha tricuspis.*

Branches glabrous, streaked; leaves crowded, semiterete, acute, glabrous; calyx short, tomentose at the summit, above the middle aristate; awns three, unequal.

On the subsaline and sandy banks of the Murray River, subject to inundations.

Next to A. erinacea.

45. *Anisacantha quinquecuspis.*

Branchlets glabrous, streaked, divaricate; leaves glaucous, nearly flat, lanceolate-linear, acute, glabrous; calyx short, villose-tomentose at the summit, above the middle aristate; styles three; awns five, very unequal.

In sandy-loamy plains near the junction of the Darling and Murray River.

Allied to A. muricata.

46. *Kochia sedifolia.*

Velvetty from a pale grey toment; stem fruticose, erect, with numerous spreading branchlets; leaves short, crowded, alternate, clavate-semiterete, blunt; flowers generally solitary; wings of the calyx nearly glabrous, hardly longer than its velutinous disk, veined, flabellate, nearly all connate, at last red.

On the limestone banks of the Murray and Darling Rivers, and in dry subsaline places towards Spencer's Gulf and Lake Torrens.

It differs from K. brevifolia not only in much more spreading growth, but also essentially in its velvet indument and in the partially separated wings.

47. *Kochia oppositifolia.*

Covered with a grey somewhat silky toment; stem dwarf, spreading, much branched; leaves short, opposite, generally crowded, triquetrous, acute, with nearly carinate backs; flowers mostly solitary; wings of the calyx glabrous, hardly longer than the thinly tomentose disk, veined red, orbicular or flabellate-reniform, disjointed.

On various saline places at Spencer's Gulf.

The opposite leaves distinguish it at once from the numerous other species.

Asteliaceæ.

48. *Astelia psychrocharis.*

(Sect. Tricella.)

Root thick; leaves rigid, from a broad base narrow-lanceolate, sharp keeled, on both sides together with the scape silky, their margin nearly flat; female racemes few-flowered, condensed to a conglomerate panicle, which is much shorter than the leaves; calyx persistent, outside silky; capsules baccate, red, ovate, beaked by the style, three-celled; seeds angulate, ovate, shining.

On wet mossy places in the Australian Alps, at sources of the Murray and Snowy Rivers.

Leaves much broader, but not longer than those of the A. alpina.

Xerotideæ.

49. *Xerotes juncea.*

Stemless, leaves long, terete or slightly compressed, streaked, with teethless pungent apex, much longer than the simple few-headed scape; flowers of each sex conglomerate-verticillate.

In the Port Lincoln district. C. Wilhelmi.

Much more robust than X. spartea, and in some degree also allied to X. leucocephala and typhina.

Juncagineæ.

50. *Triglochin nanum.*

Annual, extremely small; root fibrous; leaves narrow-linear, channeled, nearly blunt, shorter than the treadlike somewhat angular scape; fruits on spreading stalks, pyramidale-linear, consisting of three carpels, which are slightly dilated at the base, inside glabrous, on the back very thin keeled, and on both sides narrow margined.

On mossy rocks frequent in South Australia, rarer in Victoria.

Quite of the habit of T. centrocarpum.

XV.

THE WATER OF THE PLENTY RIVER.

BY JOHN MAUND, M.D.

Some months ago Mr. Jackson communicated to the Institute a paper on the Yan Yean Water Works; I then promised, at the following meeting to read a paper on the chemical characteristics of the water to be supplied by that scheme, but some additional experiments, that I was anxious to perform, has occasioned the delay in bringing it before the Society. Permit me introductorily to premise, that pure water, chemically considered, does not simply mean that it is agreeable in taste, and bright and sparkling in appearance, but that there is an entire absence of all foreign matters. Absolutely pure water consists solely of two gases, viz.:— 88·89 parts by weight of oxygen, and 11·11 of hydrogen, or of one volume of the former to two of the latter.

All water in common use contains, in addition, substances which may be regarded as impurities, such as gases which rain becomes mixed with, in its formation in the clouds, and in descending through the air; salts which it dissolves while percolating through various strata in the ground; and decaying animal and vegetable substances, which more or less universally abound on the surface of the earth.

A small amount of the two former groups of substances rarely render the water less desirable for domestic purposes, but these in excess, with organic matter, give to it various peculiarities, such as are termed hardness, softness, and also colour, smell, or taste, which renders it more or less suitable for the various purposes of life.

The water to be supplied from the Yan Yean reservoir will be derived from the Plenty River, and this, with rain water, will be the only source of supply. Analyses therefore of the water, both when the river is low, and also when it is increased in bulk by rain, will afford tolerably accurate knowledge of the character and quality we may expect to obtain when the works are completed. As I have already submitted the water taken from the River Plenty to analysis at various seasons of the year, and from different parts of the stream, I will now very briefly submit some of the results obtained.

The following is a quantitative analysis of the water taken in December, 1853, from that part where the river is to be turned into the reservoir. At this period the river was very low.

CONTENTS OF ONE GALLON, OR TEN LBS. AVOIRDUPOIS.

	Grains.
Carbonate of lime - - - - -	·60
Sulphate of Lime - - - - -	·54
Alumina and Iron - - - - -	·38
Chloride of Magnesium and Sulphate of Magnesia -	·29
Chloride of Sodium - - - - -	1·78
Silica - - - - - -	·91
Organic matter - - - - -	1·22
	5·72

The gas contained in the water was inconsiderable, and this was mostly atmospheric air and carbonic acid. The microscope exhibited little more than the presence of dead vegetable matter and sand.

Water taken at the same period above the swamp gave a total of solid matter of 4·85 grains per gallon, there being only ·37 grains of organic matter.

Another sample of the water obtained at the same period at the Lower Plenty bridge, about ten miles from the reservoir, contained 7·36 grains of solid matter, 1·97 grains of this being organic matter.

From the above statement it will be seen that the greater the distance the water flows so the impurities increase in quantity, particularly as regards organic matter, indeed this we may have expected, especially when the current was to the eye almost imperceptible. In other analyses of the water I have made at different times of the year, derived from the river where it is to be turned into the reservoir, I have found the solid matter to vary from $4\frac{1}{4}$ to $6\frac{3}{4}$ grains per gallon, but I believe the detailed analysis represents a very fair average.

If we compare the amount of solid matter per gallon with that of the waters supplied to most English towns, we find that it is greatly superior in point of purity. For instance, the imperial gallon of the following waters contain:—

	Grains per gallon.
East London River Company	$23\frac{1}{2}$
New London River Company	$19\frac{1}{2}$
Kent Water Company	$29\frac{3}{4}$
Hampstead	$35\frac{1}{2}$
Edinburgh	$12\frac{1}{4}$
Durham	$15\frac{1}{2}$
Sunderland	27
Seine at Paris	$28\frac{1}{4}$
Rhone at Lyons	$12\frac{1}{2}$
Lake of Geneva	$10\frac{1}{2}$
River Jordan	73
River Plenty	$5\frac{3}{4}$

I have consulted upwards of sixty analyses of waters supplied to towns in Great Britain and the continent, and I only find one (which exists in Switzerland) that is purer than the Plenty.

There is another circumstance which renders the Plenty water a very desirable one, this is its softness; it being less than two degrees of hardness, while the water supplied to London is upwards of sixteen degrees of hardness. This property too does not impair the taste of the Plenty water,

which is extremely fresh and agreeable. Water being soft is of great importance in both a sanitary and economic point of view; thus, it is a much more perfect solvent of all organic substances, and so is preferred for brewing, dyeing, bleeching, and all manufacturing purposes, and this property experience has proved equally applies to the various functions of the human body. Mr. Youatt says, instinct has made the horse conscious of this, for he never will drink hard water if he has access to soft. It also is an immense saving to a population in the simple article of soap, which with hard water forms an insoluble salt with the fatty acids of the soap, thereby rendering it much less applicable for detergent purposes, as the soap has first to unite with all the earthy salts before a lather can be formed. Professor Playfair says with the Thames water thirty ounces of soap are wasted in every 100 gallons of water before a detergent lather is produced; and further states, it has been calculated that in London the amount of soap and soda wasted, in consequence of the hardness of the water, is equal in value to the gross water-rental, and besides this it produces a much greater wear and tear of clothes.

I would not wish it to be supposed that I entertain the opinion that an entire absence of solid and gaseous constituents in the water is desirable for the common uses of life. Far from it, as it would so be reduced to the character of distilled water, the taste of which is vapid and destitute of freshness, and again, when we consider that water forms so important an article of our diet, the ingestion by this means of a small amount of inorganic matter cannot but render it useful in supplying the loss sustained by the daily waste of the body; but where a large amount is contained in the water, it is found to be injurious, and so, often proves the source of derangement of health, and this is especially manifest in particular localities by the greater frequency of urinary and other diseases. Thus, we find Melbourne as it is now supplied from the water containing but a small amount

of either earthy, saline, or metallic particles, that such diseases are extremely rare; while, on the other hand, its containing a large amount of decomposing organic matter is doubtless often the exciting cause of that frequent disease amongst us—dysentery.

Specimens of Water Exhibited.

No. 1.—This water was taken in January, 1854, from the Plenty River above the swamp, and has been preserved for the last fifteen months in a well corked stone bottle. It remains perfectly sweet and clear, and tastes fresh as when first derived from the river.

No. 2.—Is water taken at the same period from the Plenty River, at the point where it is to be turned into the reservoir, this remains equally good.

No. 3.—Is some of the same water as No. 2, but, instead of being closely corked, it has been freely exposed to the air. It is in all respects equal to the former.

No 4.—Is some of the same water as No. 3, but the sediment that has been deposited is allowed to remain in the bottle. This is very small in quantity and consists mostly of vegetable matter.

No. 5.—Is some water I received from Castlemaine in March, 1853. It was sent for analysis in consequence of being supposed to have produced numerous cases of dysentery. Its chief peculiarity consists in containing a large amount of organic matter and alumina, it still remains quite sweet, and is as good as when forwarded to me. I exhibit it merely to illustrate a fact that I have often observed in this Colony, viz., that water that contains even a large amount of organic matter seems to have the property of keeping sweet for a long period.

These specimens exhibit to some extent the capability of the water keeping good for a long period, and though they may not absolutely prove that the water in the reservoir will

keep equally well, still I have not the slightest doubt, from these and other observations, that if the water from the reservoir be properly filtered immediately before being distributed, we shall not have reason to find fault with its quality. The circumstance of having the water stored in a reservoir, has perhaps been more frequently urged as an argument against the scheme than any other, but this evidently is in a great measure refuted by so many towns in England being supplied with good water from similar sources. The London Board of Health, after carefully examining the subject, and having analyses made of various waters by the first scientific men, proposed to do away altogether with the river supply from the Thames, and instead, distribute entirely rain water, to be collected at Bagshot Heath and its vicinity. Again, a little while ago, the Glasgow city authorities contemplated supplying their town from Loch Katrine instead of from the Clyde. No person who has paid any attention to the keeping of water is ignorant of the fact that organic matter, such as the entomostraceæ and conferveæ are much encouraged by the water remaining stagnant and exposed to the air and light; in the Yan Yean reservoir, however, this will I believe to a considerable extent be obviated, for, in addition to a stream constantly flowing into it, the size of the reservoir is such, that the wind will do much to keep the water in motion. Again, the depth is to be considerable, so that the light will have much less effect in producing organic matter. Careful filtration too will remove from it, not only aluvium, but much of the insect and vegetable life which is certain to some extent to be formed.

Another circumstance, which fortunately the Yan Yean reservoir will possess, is its being at a distance from any town, the air in the country being so much more pure than that where a large population exists, where it is always loaded more or less with noxious gases, which rain in descending becomes mixed with. This impurity of the air is rendered

manifest to all living in densely populated towns, by the air feeling much more pure after a thunder-storm, which is occasioned mostly by nitrous acid being formed in the air, and this speedily decomposes exhalations, effluvia, &c. While adverting to this subject, I cannot forbear stating that I believe there is no one circumstance which demands better the attention of the authorities than making such arrangements regarding the reservoir as to preclude a dense population settling near its banks, for, if such is allowed, the surface water after rains is sure to convey into the reservoir a large amount of impurities, which here will be doubly disadvantageous, from there being no current, as in a river, which can convey a portion away, here all must remain in some part of the reservoir till their entire removal by consumption is effected, thereby rendering the water constantly impure.

In stating my opinion that the water to be obtained from the Yan Yean reservoir will not only be excellent, but superior to that supplied to most, if not to all towns in Great Britain, I would not wish it to be understood that I unhesitatingly state the Yan Yean scheme is the best that could have been adopted for supplying Melbourne, for, on this point, I confess, from its embracing so many scientific details, I do not feel myself a competent judge. I may mention, however, as a general rule, that I should prefer, where it is possible, on the gravitation principle, to derive the water directly from a river near its source, so that it could not be subject to contamination, rather than to any plan of storing water in reservoirs.

The only other point I wish to advert to regarding the Plenty water, is its ready action on lead, and this is not difficult to account for, as both experiments and experience have proved that the larger the amount of inorganic constituents a water possesses, so is it less able to act on lead, while the more impure it is, as regards organic matter, so, is it more likely to act on this metal. The following experiments will illustrate the action of the Plenty water on lead. I kept a

piece of lead immersed in some of the water for a week, and this water after evaporating to a fourth of its bulk, showed it was contaminated with lead to a sufficient extent, if it were constantly drunk, to produce the poisonous effects of this metal.

This circumstance, therefore, should be a caution to the public against using lead pipes, cisterns, &c., for poisoning by lead in this way is by no means an uncommon occurrence, and from being introduced into the system gradually, it becomes a most insidious poison, producing the most serious derangment of the health, which unfortunately is but slowly, if ever, restored, from the disease being often attributed to other causes.

XVI.

GAS AND GAS WORKS:

CONSIDERED

IN RELATION TO THE PRESENT CIRCUMSTANCES

AND REQUIREMENTS OF THE COLONY.

BY A. K. SMITH, ESQ., C.E., F.R.S., &c.

(Continued.)

READ JUNE 7, 1855.

Fourthly and lastly, the application of Gas to public and private uses.

The three great arguments at one time advanced against

the use of gas are now almost annihilated although we hear them quoted, either for one reason or another, as a mode of illumination more dangerous, more unhealthy, and more costly than the more common methods of obtaining heat and light.

It fortunately happens, however, that from the progress of collateral knowledge, that the first of these objections has long ago received a conclusive answer through the experience and practice of our insurance companies, who are now so perfectly convinced of the safety of gas, that they neither make any extra charge, nor require any notice or intimation whatever upon its adoption, as a luminiferous or calorific agent, in place of lamp, candles, or coals. Here then we have the best of tests, the money-test, the test of self-interest, a kind of evidence it is impossible to controvert, coming as it does from a class of the community not very liable to be deceived in such matters, and this test so powerfully demonstrated the entire safety of coal gas (here I quote from the admirable paper by Lewis Thompson, M. R. C. S.), that I will henceforth dismiss it without the ceremony of discussion. No man of common sense now-a-days believes that there is any real danger in the use of coal gas. But the question of unhealthiness or insalubrity is not so easily disposed of, for here we have unhappily no insurance evidence to assist us, and even the bills of mortality are inconclusive, nay although it is quite notorious that the workmen constantly employed about gas works enjoy excellent health, and live to a good old age, yet this only proves, we are told, that they are "used to it," or like Macbeth they bear a "charmed life." Perhaps it would be impossible to point out a more remarkable instance than the above of the effect of prejudice on the imagination; there are thousands who firmly believe that coal gas in burning gives off some highly deletereous compounds, from which wax, tallow, oil, and even coals themselves are free, and this belief is supposed to be corroborative testimony in the shape of facts displayed in the creation of disease, or in the misconceived

opinions of medical men; but the real truth of the matter is, that whether gas be burned under the name of gas or not, can make no difference whatever to the advocates of this strange prejudice, for under all the circumstances used in the ordinary burning of wax, tallow, oil, &c., &c., it is gas, and nothing but gas that is burned, the only difference being that, coal gas is always purified before it is consumed, whereas the extemporaneous gas of a candle or lamp is consumed without being purified at all, and hence, light for light, it must and does vitiate the air of an apartment vastly more than coal gas. If, therefore, it is true that gas is insalubrious, then wax and oil must be decidedly more so, from the simple fact that all the impurities they evolve pass into the atmosphere of the locality lighted; whereas the great bulk, at least, of these from coal gas remain at the gas works. The actual question consequently for the public to consider is, not whether the burning of gas be injurious to health, for, in one shape or another, gas must be burned to procure light, but the point is, whether is it better to consume for this purpose gas of a pure or impure quality.

In an earlier page of this paper, I mentioned that a wax or tallow candle was simply a gas work on a small scale, consuming the gas generated immediately on its production and without having its impurities removed; now those impurities arising from coal are conducted through instruments called condensers, scrubbers, and purifiers, where the impurities are arrested by various means, so that, in the end, pure gas only is sent to be consumed by the public. Thus, then it would appear, that the advocate for wax and tallow illumination is not only a manufacturer and consumer of gas, but, what is worse, a manufacturer and consumer of the most impure kind. It is well known that the red hot wick of a recently extinguished candle continues to give out a dense fetid vapour or smoke which readily kindles on the approach of a lighted match—this smoke is nothing but impure gas, the very gas constantly burned by the wax and

tallow advocate, and which, if properly condensed and purified, would resemble coal gas, the two differ only in respect to purity, and I (Lewis Thompson) have entered thus minutely into the question, for the purpose of showing the extraordinary power of prejudice, because, although it follows as a necessary consequence of the above comparison, and is moreover susceptible of positive proof, that all the ordinary agents employed to give light evolve more impurity and vitiate a larger amount of atmospheric air than coal, yet many tolerably well educated persons are to be found who have argued themselves into a belief the very opposite of that which is the correct one. With regard to the last argument, that gas is more costly than light from wax, sperm, &c. &c., but little need be said, as it is now universally admitted that gas is the cheapest where a considerable amount of light is required, yet, strangely enough, it would appear that where but little light is needed gas is not cheaper when consumed in the fittings or burners generally in use; this arises from those burners being fixtures, and hence an equally near position to them is not always attainable, as to that of a lamp or candle; it is true this can be remedied by having a flexible Indian rubber tube, or by the use of elbow-joints, &c., as in Scotland, where the light is brought into proper proximity with the object in view, but unless this is done, as before stated, gas is not cheaper where little light is required, for this reason, that the effect of light diminishes in proportion to the square of the distance, it is clear that a single candle placed at two feet from any object will illuminate that object as strongly as thirteen candles, or a gas light equal to thirteen candles, would do, if placed at a distance of little more than seven feet. Thus we see the advantage of position which the common candle possesses, and which compels the public to consume, as a general rule, thirteen times as much gas, and to generate thirteen times as much expense, heat, and inconvenience as would be incurred did

we possess facilities for bringing the gas we burn into the same advantageous proximity as the candle; and the above fact requires also to be kept in mind by those who would substitute a gas light in a fixed position for any other portable light in common use.

The relative quantities and cost of gas and sperm candles have been obtained by photometerical experiments, the results of which are, that 1,000 cubic feet of common gas was found to yield a light equal to that derived from 312,000 grains or 44 4-7 lbs. of sperm candles—assume the price of gas to be 25s. per 1,000 feet and the actual cost of sperm candles 2s. 6d. per lb. (the present selling price in Melbourne is 3s. 3d.), we would have for equal quantities of light:—

44 four-sevenths lbs. of Sperm Candles at 2s. 6d....	£5	11	6
1,000 feet of Gas, at 25s	1	5	0
Leaving a balance in favour of Gas	£4	6	6

or nearly four and half times cheaper than sperm candles.

From the preceding facts, I think it will be admitted by every candid inquirer, that in point of safety, salubriety and economy, coal gas not only rivals but greatly excels every other form of illumination yet within the reach of the public, and I know of no reason unless ignorance and prejudice may be dignified by the title, why gas should not be universally employed in all the cities and towns, in our public and private edifices, in our workshops, and in our parlours. Amongst many other useful purposes to which coal gas may be applied besides those of lighting our streets and houses, I may mention that its introduction into the hall, the kitchen, the bath room, the laundry, and the stable, has been attended with signal success. In the hall it can be used to warm and ventilate the house, in the kitchen to cook our victuals, in the laundry to heat iron for the preparation of our linens, in the bath room for the purpose of heating the water, in the stable for the singeing of horses, &c., &c.

In the colony of Victoria cooking and warming by gas has great claims to our attention for several reasons, that, though important here, are of less consequence at home and in other countries. I refer to the sudden change of temperature, often varying as much as thirty degrees Fahrenheit in a few hours, and also to the fact that in no part of the world does the saying of "time is money" admit of a broader or more truthful application than here.

The public of Great Britain have been much indebted to J. O. N. Rutter, Esq., for many excellent hints on the use and abuse of gas; and in a paper read before the Society of Arts, in 1853, he proceeds to say,—"It may not be immediately and not without its advantages in promoting the sale of gas, if its applicability to heating purposes be a little more attentively considered, the proper methods of using gas need only to be understood to become popular. The actual and relative cost of such is not of so much importance as may be imagined. In the every day business of life, out of doors and in-doors, we willingly pay something extra for comforts, conveniences, and luxuries; so it is with gas as fuel, the most simple, comfortable, and healthful means of adopting it ought to be the first consideration, if it cost more than a common fire as a matter of £ s. d., it possesses advantages of another kind which money will not easily purchase."

Mr. Chairman and Gentlemen, understanding that other papers will claim your attention this evening, I draw this paper somewhat abruptly to a conclusion, at its commencement I stated that I would refer to, and quote from, various authorities on the subject, I have done so; and lest I should be accused of plagiarism, I beg again to acknowledge the fact.

I have to thank you for your attention to a Light subject although it may have been rather Heavily treated.

XVII.

KEILOR BRIDGE.

BY EDWARD RICHARDSON.

READ JUNE 7, 1855.

In this colony, as in all other new countries, particular attention has been paid to the formation of roads and bridges, the latter requiring in many instances much skill and ingenuity.

Timber bridges, in the natural order of things, seem to be the first; they may be found in many rural districts where science in these matters is unknown.

For instance, it is but natural to place two logs across a stream of small dimensions, and on these logs place transverse timbers, and then a crossing is obtained.

The subject of the present paper is one of these instances, two of these rusticated bridges have been erected over the stream of the Keilor River, but the issue is too well known to repeat here, not only waste of labour, money, but loss of valuable lives.

Keilor is ten miles from Melbourne, situate on the main road to the Gold Fields. The Salt Water River rises here in floods to thirty feet or more above the bed of the river.

About two years and a half ago the traffic on that road exceeded that of any road in England, and yet no provision was made for a crossing, several old structures being washed away.

The present bridge was designed according to the requirements of the site, being built on an American principle, there

called Howe's Patent. The length of the bridge is 160 feet, its span 135 feet; it consists of two abutments of solid masonry, 38 feet high, the outside courses being hammered and dressed, and the hearting of rubble masonry. The superstructure of the bridge consists of three trusses placed on these abutments, the floor resting on the lower stringer of these trusses; it has two road-ways, each 10 feet 6 inches wide.

At the time the plans of this bridge were sent to the Lieutenant-Governor, Mr. Latrobe, there were only two contractors in Melbourne considered competent to undertake the work, one of these being the successful tenderer; the bridge was undertaken with the sanction of the Executive Council in March, 1853.

The contractor, Mr. Thomas Oldham, proceeded with the works as far as the masonry was concerned till the eve of its completion. The framing of the first truss was also completed, and I must say not without many difficulties. The terms of the contract left the whole of the responsibility with the contractor, as far as the erection and carrying out of the works as per plan and specification. The contractor, being a gentleman of great practical attainments, undertook to build the trusses according to his views, although repeatedly advised by the engineer to the contrary. The trusses were first framed on the ground and then set on edge, and latterly launched across the stream on edge.

This was an undertaking of no small mechanical skill, and is worthy of the man who projected the plan. A truss 17 feet high, 50 tons weight, and 160 feet long, to be removed across a chasm 100 feet, even with English means, would be considered no mean undertaking, and I am happy to say has been here performed successfully, but at the same time with a sacrifice to the contractor. The first truss was carried across without any accident or obstruction except that of enormous expense. It may be well here to describe the way

in which the truss has been raised on edge, canted and launched across the stream.

In raising the first truss recourse was had to wedges, these were entered at equal distances throughout the whole length of the truss; great care was taken to drive them simultaneously so that the truss might be raised equally from end to end, the truss was blocked up as so raised, subsequently jack-screws were used, and when nearly upright guy-ropes were attached to the top stringer, in order to keep it in its proper position when up, to these guy-ropes crab winches were applied, and by this means the raising was completed. The second truss was raised about four feet from the ground by means of jack-screws, and the remainder by four sets of shears, this plan being adopted as more secure and expeditious.

Owing to the nature of the ground, the position in which the trusses were built caused them when raised to stand at an angle of sixty degrees to the axis of the bridge, this involved a new difficulty, and three sets of "slides" or "ways" had to be laid something similar to those used in launching vessels; on the first of these the truss was moved endways about thirty-five feet; on the second about twenty; and on the third, which was nearly parallel to the axis of the bridge, about forty feet; the overhanging end was here landed on a stage built for the purpose, and the truss moved on its full length across the stream; owing to the inclination obliged to be given to the slides, the lower end was from twelve to fourteen feet below the top of the stone pier, and recourse was had to shears and powerful blocks and tackle, to lift the truss to its final resting place.

The second truss was more expeditiously raised; by the suggestions of the engineer, instead of raising the truss by screw-jacks entirely, four crab winches were provided, and shear legs to correspond, to which were attached blocks and tackle, the four crabs working simultaneously; the second truss was raised on edge, but in launching the truss lost its balance, and that portion of the structure fell to pieces.

The case being one of great difficulty the Government allowed the contractor to proceed with the work until this truss was rebuilt and carried over, on the condition that the resident engineer was responsible for the completion of the work. This being the first time the engineer was allowed to interfere with the arrangements or mode of carrying on the works.

It may not be out of place, that the engineer, Mr. George Holmes, previously expressed his dissatisfaction as to the plans proposed for erecting the bridge, his own notion being to erect a temporary pile scaffolding, and on that to erect the truss, but, as matters then stood, and taking the position of the broken truss, it was thought advisable to conform to the contractor's views and assist him—suffice it to say, the second truss was launched safely and placed in its position without accident.

The third truss was, by my own instructions, built on a platform resting on the two trusses previously carried across, and in one-third of the time and expense taken to place either the others in its position, which evidently proves the suggestion of the engineer in the first instance, that is, to build the bridge on a platform.

There are several bridges of a similar design now on American railways, ranging in span from 100 to 250 feet, where the span exceeds 150 feet a lamenated arch is generally introduced to assist in taking the weight off the middle of the truss, and transferring it to the branches, or eventually to the abutments of the arch.

The design of this bridge has been found to answer very well in America and in many places in Great Britain. The truss is simple and of great strength, no skilful mechanician is required, and the village carpenter of any country district may, if needs be, construct a similar bridge.

The lattice bridge had been in vogue for a long time in America, these seem to have given way to Howe's truss on

analysation and on its merit. The strength of Howe's truss is not interfered with by inferior mechanism so much as the others, and its means of adjustment vastly superior and more simple. Due inspection of the plan which is exhibited, will show some points which are evident to every one, as being simple and efficacious; the principle one of these is the tension or suspending rods, which are capable of adjusting the truss from the effects of the atmosphere, this may appear not worthy of particular notice, but in this colony it is of paramount importance, especially where colonial timber is used.

As to the strength of the truss, it may be easily obtained by a simple formula, but yet calculations are not always to be depended upon, the workmanship has to be looked after, and, from time to time, a suggestion and particular attention to details is often of more importance in the stability of a structure than is generally considered; as an instance, a design by the engineer, of a clamp was introduced, which proved its efficacy in the broken truss, the truss was broken in three places, but in no instance where a joining of beams took place did the clamp give way.

In calculating the dimensions of the various timbers in this bridge, a liberal allowance was made for defects in workmanship.

It may now safely be said, it has fully sustained its expectations, for I have myself oftentimes watched it, and could not at any time find any sensible deflection and very little vibration; finally, my firm belief is, if this bridge were enclosed and weather-boarded, it would last thirty years; the cost of the bridge 160 feet long, having two stone abutments thirty-eight feet high, above ordinary water level, was £11,000. Taking into consideration the time this bridge was built, when mechanics had 35s. per diem, and labourers from 12s. to 18s., it will bear a comparison with most of similar constructions, in Europe and America, in point of expense and workmanship.

XVIII.

WROUGHT IRON BRIDGES AS ADAPTED TO THE COLONY.

BY FRANCIS BELL, C.E.

READ JUNE 7, 1855.

In submitting this short paper to the Institute, it is my object to bring forward and invite discussion on a subject that I consider of the greatest importance to this colony at present, not only as regards its monetary condition, but with respect to its future prospects.

The subject of my paper this evening, is to show the great saving that would be effected by the introduction and construction of the wrought iron lattice girder bridge over every other kind of bridge, not only on railways, but on public roads. Since my arrival in the colony I have maturely considered this subject, and regret to find that so little notice has been taken by engineers of the materials and construction of bridges most adapted to the colony. The favourite material used at present seems to be wood, which does very well in the country districts for small spans, where large logs can be conveniently had, but where the spans increase to twenty-five feet and upwards, some other safer material should be used.

The timber of this colony is not well adapted for bridges of large spans, owing to its great tendency to warp and shrink, and also to a peculiarity which I have not observed in other timber, viz.: it shrinks with the fibre or lengthwise, this, as must be evident to even an unprofessional man, is a

very serious matter in engineering works, and I have found from experience at home, where timber does not shrink so much as it does in this warm climate; that in the summer the greatest attention is required to prevent shaking and oscillation, and additional stays and straps are frequently added to try and prevent this, but with very little effect, for the wood must shrink, and the iron straps, bolts, and tension rods expand at the same time, and in the winter season *vice versa*. Then, surely in this colony where the heat is so intense in the summer, all these effects must be greatly increased, and if it can be shown that a bridge or Viaduct could be constructed without these faults, and at a much less cost than wood, and infinitively less than stone, it would be of vast benefit hereafter, and would enable most important and useful works to be proceeded with that otherwise would be long delayed.

To illustrate this more fully, I will suppose a deep river has to be crossed with a span of fifty feet. I have made estimates of three different kinds of materials for spanning it, calculated at the present colonial prices, they are as follows, leaving out the abutments, which I have supposed to be the same in all:—

Constructed of stone it would cost	£5,000
Constructed of wood	1,600
Constructed of wrought iron lattice . . .	550

Thus, it is evident the wrought iron lattice girder bridge of the form I propose, is immeasurably the cheapest; and now to determine its durability and strength. In the year 1847 I designed and had constructed of this formation, for the Cork and Passage Railway in Ireland, girders of fifty feet span; the cost for a double line of rails or three girders including flooring, was £414; weight 17 tons 3 cwt. 1 qr.; add to this freight, and cartage on 18 tons, with additional cost of erection in the colony, and it will come to about

what I have put down, £550; as this was the first lattice girder bridge of this form, constructed, Sir John Macneill was naturally anxious to test it, and Captain Wynn, the Government Railway Inspector put it to very severe tests before allowing this line to be opened for traffic; he caused one of the largest locomotives, with the tender filled with water and coke, weighing twenty-five tons, to rest on the centre of the girder, afterwards he caused the engine to be run across the viaduct at the greatest velocity attainable, at the rate of about seventy miles an hour—with all this there was not the slightest deflection observable.

I had several smaller girders afterwards constructed, of which these are drawings,* and afterwards on the Great Southern and Western Railway, and on the Killarney Junction Railway, I had six or seven constructed of different sizes and spans, and all with equal success, and since I have been in this colony I have had letters from the contractor stating he had orders for several others from three different railway companies, that they were the strongest, cheapest, and lightest bridges that could be erected, and were coming into general use.

To enumerate some of the advantages of adopting them in this country would be: the great facility of transport; for the lattice bars could all be cut, punched, and fitted, before coming out here, the entire being so light and in such small pieces, the cartage would be very trifling, and the rivetting could be easily done on the ground; then neither centring, scaffolding, or any expensive machinery is necessary, for all that is required for fixing them in their position is a few rollers and a crab windlass, as they can be rolled along the approach and placed with the greatest ease.

In conclusion, I have a strong conviction of their great superiority in strength, durability, and cheapness, for traversing large spans, and I have no hesitation in advocating

* The above drawings were laid before the meeting.

their introduction; it is, however, most essential, before opening them to the public, to submit them to severe and satisfactory tests; these tests have been various and frequent on those that have already been opened, and it may be safely affirmed, that in no case where Wrought Iron Box Lattice Girder Bridges have been duly proportioned and executed, has there been the least reason to doubt their security; they, furthermore, admit of being highly ornamental, and have, when erected, a most elegant, airy and light appearance.

I regret much that I have not been able to get a model prepared, as I had intended; it would have fully shown the construction, and enabled me to put it to a test, before this meeting.

I might here suggest that Prince's Bridge could be very easily widened by removing the present parapet and supporting the footpaths outside on a modification of the lattice girder, supported partly by brackets, this could be done at a very moderate cost, and be of infinite benefit to the public.

XIX.

THE TRANSLATION OF LANGUAGES.

BY WM. SYDNEY GIBBONS.

READ JUNE 7, 1855.

The short paper which I have now the honour to lay before the Institute embodies views which I have at former periods had occasion to set before my pupils. The tone is necessarily

somewhat didactic, this I should have been glad to have avoided as inappropriate to the present occasion, but, on reconsidering the subject, the course of requesting the indulgence of our members, appears to me to be preferable. It will not then, I trust, be deemed to imply any want of deference to the Institute, when a little of the Educator peeps out, and I employ, because they present themselves to me as the most suitable, phrases and illustrations that seem to savour of the class-room.

The remarks I have now to make were originally suggested by observation of the extreme poverty of most of the recognised translations of classic authors generally, and the English versions of many modern foreign writers. This remark applies especially to versified translations, in which violence is done to the spirit and verse of the original without any countervailing advantage being presented to the reader. Such a work is neither an English poem, nor a translation of the Classic; a certain imperative adherence to the style and manner of the author has served to cripple the translator, who has only thus far allowed himself to be guided by it, and has utterly disregarded the beauties everywhere apparent in the peculiar terms of phraseology, and in artistic selection of words from the synonyms at command. I trust that in the following remarks I may be able to justify this heretical condemnation of writers whose names have passed into the list of English Classics, and may support successfully my view that the most free translation is really the least so, and that the closest literal rendering will produce the boldest and most forcible translation.

The great end of translation is to convey into one language sentiments originally expressed in another. It is but too frequently the case that what is called a translation is little more than an original work composed on the basis of that professed to be translated. This observation is fully borne out by a perusal of the principal poetical translations (so called) of the Classics by some of our eminent writers, who have

in these works not only cramped their own powers, but failed to render the beauties of their originals. Attention to the following observations will remove many of the difficulties which commonly arise, and will lessen the risk of falling into the errors above-mentioned.

I. In order to convey fully and accurately the sense of the author, without loss of spirit and delicacy, other than must necessarily follow from a change of language (this deterioration may however be reduced to almost a nullity,) it is requisite to exercise the greatest care in the selection of words, so that the form of the classic sentence may be preserved, and the full force of expression arising from the use of particular idioms and words may be obtained without any other change than the conversion of idiom, or rather inversion of sentence in deference to the idiom of another language.

A few remarks on the process by which this end is best accomplished may be admissible here; and I would deprecate the idea that this is common-place or that, because the terms are used in teaching, the process itself really forms a frequent part of education.

First, the words, when their syntactical relations are determined, should be rendered literally and in the classical form of sentence. The various radical significations of each of the words may then be tried and compared until the true sense of the author is discovered and is verified by the context. The bare sense having been thus obtained, the sentence as it stands in its rough purity may be gradually polished, by the change of order and the substitution of one synonym for another which is found to be more forcible or more consistent, until it assumes the aspect of elegant English. In doing this care must be exercised in the selection of synonyms, so that all the principal inflections may be rendered by similar forms in English, that all confusion of subject and object, &c., may be prevented, and the ideas contained in the original may be conveyed without any conversion of

phrase. And the possibility of construing the original, word by word, into the adopted translation, with only such modification as does not do violence to either the letter or the spirit of the author is the best test of the fidelity of a translation to the original, as the elegance of its construction as a whole is the best indication of the mastery attained over the language into which it is rendered. Nor is this so difficult as might be supposed, for, except in some peculiarly elliptical expressions, a judicious selection of the various admitted significations of words, and a careful survey of their derivation, added to a due observation of their syntactical relations, will enable the student to give the spirit and force of free English to a translation, which on close comparison with the text, seems to be, and is, purely literal. Indeed, it generally happens that a translation made on this plan and in pursuance of these instructions is more forcible and more poetic than what is commonly called a free rendering, in which the translator jumps at a supposed idea, and moulds it to his own taste, abandoning all attempt to give the style and weight of the author. In fact, a so called free translation is too frequently a substitution of the ideas as well as the words of the Translator for those of his Author: whereas the *analytic* and *synthetic* processes enable us to give a version which varies only in tongue from the text, and renders not only the ideas, but the actual words of the poet or orator into their etymological equivalent.

II. In order for the student to place himself in a position to effect the necessary modification of construction and selection of words, it is essential that he regard the two ruling principles of language, Etymology and Syntax.

Syntax, or the construction of sentences (συνταξις—συν,τασσω), shows the relations in which the words stand to each other, and, consequently, the expression of the idea, by displaying fully the arrangement of the materials by which it is expressed; and so gives the key both to the conception of the author and to the mode of setting it forth in another tongue.

Etymology, or the structure of words (ἐτυμολογια, ἐτυμος–ἐτεος ἐιμι, λογος) shows the power of each constituent of the sentence and its derivation, by a strict examination of which its radical or natural signification may be traced, and from which its acquired meaning may be deduced; and the means of finding a suitable and expressive synonym are at once provided.

In order, however, to attain this power, a minute attention to the details of Etymology is indispensable, as without it no certain knowledge of the identity of any word, nor any definite conclusion as to its origin, can be arrived at. Accurate observation of the accidence of words, or their peculiar inflections arising from their syntactical relations, is also essential to a right knowledge of the syntax of the sentence, and the consequent function and power of each word, as well as of the identity of the words themselves and of their significations as derived from their roots.

I shall not trespass on the time of the meeting by entering upon examples or by going farther into detail. Instances where the plan I advocate would have obviated all necessity for weakening the original by distorting the phrases to agree with our notions of idiom, notions that set at naught the true origin of idiom, viz. :—a concise and somewhat corrupt setting of an idea in words that have since become as obsolete as is now the legitimate sentence in which the sentiment could have been conveyed at the time the corruption first occurred: a careful analysis of such an idiom enables the student to refer each peculiar form of speech to its source, and then re-construct it in an analogous manner in his own language.

In the same manner rhetorical figures, tropes, and metastases may be re-produced with literal fidelity, and with scrupulous regard for the artistic beauty of the original idea.

I trust that I have now supported, as far as is possible within the limits of a single paper, the somewhat paradoxical proposition with which I started, viz. :—that the most free

translation (so called) is the most cramped, while the most literal rendering is the most bold, and faithful, and forcible.

XX.

THE MANUFACTURE OF SULPHURIC ACID AND STEARINE CANDLES.

BY A. K. SMITH, C.E., &c. &c.

READ JUNE 7, 1855.

It may seem somewhat strange that I should have chosen such a subject for a few brief observations to-night, and it does at first sight appear somewhat anomalous, that a gas engineer should recommend the establishment of a manufactory for the production of light other than gas. Still I feel certain that you will join with me in taking a more liberal view of the matter than the contracted one of advocating the introduction of one branch of manufacture at the expense of another. Personally interested as I am in coal gas and its manufacture, I fear no rival, well knowing that the £ s. d. test (independent of the convenience and safety of gas) will be the great champion in the cause.

In the moral, as in the physical world, the first mandate is equally applicable—"Let there be light"—and not only darkness but vice will be diminished. Implicitly believing in the assertion, I consider I am only doing my duty as a member of society, in pointing out to those who will not be in a po-

sition to avail themselves of gas when the city is lighted, the means of obtaining a good substitute at a cheap rate; that such a substitute can be manufactured cheaper than we can import it, I propose to make manifest.

If we refer to the statistical accounts of colonial produce exported from Victoria in the four years of 1850-1-2-3, we will find that no less than 11,096 tons of tallow were exported, the average value of which is estimated at 3½d. per lb., and that in 1855, to the 19th May, 446 tons were shipped from the port of Melbourne alone. The imports of candles during the same dates amount to nearly 3,000 tons, and the quantity, for the first quarter of 1855, received into the port of Melbourne alone, is 341 tons, at an estimated cost to the public of 2s. per lb. (the present selling price being 3s.), amounting collectively to £76,384, upon which the public lose, as a minimum, not less than £29,644, independent of losing at least sixteen and a half per cent. in the tallow shipped. Mr. P. A. Walker, in the *Argus* of June 5th, in remarking the inconsiderable quantity of tallow at present exported, in comparison with the time when boiling down was practised, proceeds to say—"However, as roads are improved in the interior, and the expenses of transit lessened, the quantity will increase, and form, as before, an important item in our exports. From the reports of individuals to be relied on, the quantity of 'butchers' fat' wasted in the neighbourhood of the various diggings is immense, and, if it could be conveyed to Melbourne, would prove a source of employment and wealth, whereas now it is only a generator of disease in the neighbourhood where it is wasted." I am led to notice these remarks, in order to prove that we have the raw material for the proposed manufacture, and that the demand for the manufactured article would equal the supply even *where* the stimulus of a higher price was offered.

With this preface I will now proceed to make a few remarks on the manufacture of sulphuric acid and stearine candles:

in doing so I beg to acknowledge the co-operative assistance of a French chemist, Monsieur Francis Maudit. The speculation I am about to propose would be of benefit to the colony at large by furnishing a necessary article at a reasonable price, as well as proving remunerative to the parties engaged therein, independent of a handsome interest or profit on the capital invested. As before mentioned, one of the principal articles this colony exports is tallow, notwithstanding that the produce does not at present far exceed the wants of the colony. It is returned to us in the shape of stearine candles, thereby causing the public of this colony to bear all the expenses resulting from the double transit, and to lose the profits which all parties engaged in this traffic must reap.

As to the expenses of this manufacture, it would be far better that the money should remain in the colony. Nor is this all, for it is the supposition that the importation will be regulated by the consumption and a fair and regular price maintained, which is not the case, for the public are sometimes obliged to pay double and treble the cost price of these articles, to the entire benefit of a few individuals engaged in this commerce, who make as it were a monopoly of the trade, which so largely remunerates them, and they will no doubt endeavour to keep things in this state as long as possible, if a stop is not speedily put to this abuse by the only means which would attain that end, that is to say, by the establishment of a manufactory of stearine candles in this city.

It will be perceived at a glance, that all these abuses would be put down at the moment a manufactory, established here, began to furnish the market. A fair price would be maintained, which, in the end, would bring the said manufactory in direct competition with the English market, with which, however, it would be able to cope, leaving large profits to the parties engaged in it. This is what I propose to prove by the calculations which will follow. To carry out the above it would be, however, necessary to make the sulphuric acid re-

quired in the manufacture of stearine candles, seeing that the acid attainable in the market costs from £1 8s. to £2 16s. per cwt., which prices would materially affect the profitable manufacture of candles, whereas we could make it at 9s. per cwt., which would render all competition useless, and leave the market entirely in our own hands for the disposal of the surplus acid that we should manufacture. The quantity imported is but were we to dispose of it at the rate of 18s. per cwt. the consumption, I have no doubt, would be doubled, as at present it cannot be applied to many useful purposes on account of the exorbitant cost price. I might instance the manufacture of that valuable and highly concentrated manure, superphosphate of lime. Its use is so general that many new branches of industry would spring up if it could be obtained cheap.

In all cases we could restrict the manufacture, or make use of the surplus for the fabrication of crude soda and muriatic acid. The expenses attending the manufacture of sulphuric acid would be as follows :—

Sulphuric, 6 cwt., at 10s. per cwt.	£3	0	0
Nitrate of soda, 40lbs., at 20s. per cwt.	0	7	0
Coals, 12 cwt., at 70s. per ton	2	2	0
Two men and one boy	1	10	0
Divers	0	10	0
	£7	9	0

PRODUCE.

1890 lbs., at 66—nine-tenths of a penny cost price per lb.
Or 2170 „ „ 60
Or 2360 „ „ 55
Or 2590 „ „ 50

I will now proceed to show the expenses attending the manufacture of stearine candles :—

Tallow, 2000 lbs., at 6d. per lb.	£50	0	0
Lime, 260 lbs., at 10s. per cwt.	1	8	0
Sulphuric acid, 560 lbs., at 1d. per lb.	2	8	4
Labour	5	6	0
Fuel, one ton	3	10	0
	£62	12	4
Manufacture of 900 lbs. of candles	7	10	0
	£70	2	4

PRODUCE.

Stearine candles 900 lbs.
Oil ..... 1100 „

Should any sulphuric acid remain after deducting for the above and the supply of the market, we could employ it for the manufacture of crude soda and muriatic acid, or restrict the quantity made to the exact demand. Without entering into the details of the materials required, I shall merely state that we could manufacture

1650 lbs. crude soda, cwt. $14\frac{2}{3}$
1500 „ muriatic acid, at 22 } £16 1 0

The surplus muriatic acid, after the supply of the market, could be made use of for the extraction of gelatine from bones. I will now recapitulate the daily expenses, adding thereto the incidental expenses and the produce, to see the profits of the undertaking :—

Manufacture of 2170 lbs. sulphuric acid	£7	9	0
Interest of £2,000, at ten per cent. per diem	0	11	0
Manufacture of candles	70	2	4
Interest of £3,000, at ten per cent. per diem	0	16	6
Clerks and office expenses, at £600 per annum	1	13	0
	£80	11	10

PRODUCE.

Stearine candles, 900 lbs., at 1s. 3d., per lb.	56	5	0
Oil, 1,100, at £40 per ton	20	0	0
Surplus acid, 1,500 lbs., at 2d. per lb.	12	10	0
	88	15	0
Sale of produce	88	15	0
Expenses	80	11	10
Profits per diem	8	3	0

In conclusion, I will beg leave to state that the profits could not be less, and may be greater, seeing that I have rather exaggerated the expenses than otherwise, which fairly bears

out what I stated in the commencement, viz., that this undertaking would be highly remunerative to the capitalist who would engage in it, as well as result in great benefits to the public of this colony.

Goodhugh & Trembath, Printers, Flinders-lane east.

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Hoseason, R., Esq.
Holmes, George, Esq.

Jackson, M. B., Esq., C.E.

Kentish, N. L., Esq.
Knight, J. G., Esq.

Lewis, G., Esq.

Moody, J. J., Esq.
Morse, H. P., Esq.
Maund, J., Esq., M.D.
Mueller, F., Esq., Ph. D.
Martin, J., Esq.
Moore, J., Esq.
Mayne, E. G., Esq.
McDermott, Townsend, Esq.
McDonogh, M. T., Esq.
Michie, A., Esq.
Montefiore, Jacob, Esq.

Ohlfsen-Bagge, C. H., Esq

Pasley, Capt. C., R.E.
Pritchard, D., Esq.
Pyke, T. H., Esq.
Powlett, F. A., Esq.
Palmer, J. F., Esq.

Robertson, W., Esq.
Richardson, E., Esq.
Rawlinson, Thomas E., Esq.

Sinnett, F., Esq.
Selwyn, A. R. C., Esq.
Smith, A. K., Esq.
Smith, W., Esq.
Smith, L. L., Esq.
Stewart, B., Esq.
Semple, J., Esq.
Slade, Edgar, Esq.

Venables, H., Esq.
Verdon, G., Esq.

Wilson, E., Esq.
Whipham, T. W., Esq.
Watts, C. H., Esq.
Wright, W. H., Esq.

ABSTRACT OF PROCEEDINGS,

&c.

PUBLIC PRELIMINARY MEETING,

15th June, 1854.

His Worship the Mayor, having been called to the chair, briefly noticed the importance of the subject the meeting was summoned to consider, and called upon Mr. W. S. Gibbons, the Promoter of the scheme, to explain his plans.

Mr. Gibbons said he felt that the position of prominence which he had assumed in the matter called for some apology. He had felt the importance and necessity of the work he had taken in hand, and his regard for the object induced him to undertake the matter. It was common enough for people to express their regret that there was no scientific institution in the colony, but no one was willing to incur the responsibility, the labour, or the risk of failure. He had therefore originated this movement, and invited co-operation, and he hoped that the step once taken might lead on to success. Having gone so far as to summon the meeting, he felt bound to produce a scheme as full and complete as it was possible to lay before a preliminary meeting. He read the following series of propositions for the constitution of an institute, which he submitted to the meeting for its consideration; and he begged to say that he had no idea of thrusting his propositions forward, but put the draft of a constitution suggestively.

VICTORIAN INSTITUTE.

Resolutions to be proposed at a meeting to be held in the Mechanics' Institution on Thursday, 15th June, at four o'clock, p.m.

1. That a society be formed under the style of the "Victorian Institute for the Advancement of Science;" and that its objects be the establishment of a means of communication between persons engaged in the pursuit of science, and of cultivating a refined taste among the people of Victoria; a centre for the collection of observations and specimens from all sources, and the gradual formation of a museum; a source to which the community generally may look for information on scientific

subjects; and an agency for the development of the resources of the colony.

2. That the Institute be composed of all persons who may be admitted by ballot under regulations to be made by the Council for that purpose.

3. That the Institute be governed by a Council, composed of the President, Vice-President, Treasurer, and Secretary, and six elected members; the same to hold office for one year, with power to be re-elected, with the exception of the three non-official members who shall have been last on the poll; that in future elections a qualification of usefulness to the Institute (to be hereafter fixed) be required of all candidates for office; and that all such offices be honorary.

4. That the meetings of the Institute for general business be held once in each month; and the Council meetings for business of detail at a convenient time between such meetings.

5. That the subscription of ordinary members be (£4) per annum, with an entrance fee of (£2); and that the subscription fee of corresponding members be (£2) per annum, with an entrance fee of (£1). All subscriptions to be payable in advance.

6. That the Council elect its own Chairman.

7. That the Council be instructed to draw up rules for the internal government of the Institute, the same to be subject to confirmation by a general meeting.

8. That the Council appoint sections of the Institute, consisting of not fewer than three members each, for the consideration of questions appertaining to particular sciences; and that any number of members, not fewer than three, may request the Council to appoint them a section, provided that the branch of science they propose to prosecute has not before been provided for.

9. That every such section be empowered to elect its own chairman, and make rules of detail on matters peculiar to itself; such election and rules to be confirmed by the Council, if not repugnant to the constitution or general laws.

10. That the apparatus and museum be vested in one or more Curators to be appointed by the Council.

(The propositions were well received and great interest was manifested in the object.)

Mr. Gibbons then said, that with the view of eliciting discussion, and of testing the opinion of the meeting, he would move the several clauses seriatim as distinct motions, explaining his reasons in support of each, and leaving them to be seconded and adopted if approved, or to have amendments moved on them.

He then moved the first clause, which set forth the necessity for a scientific institution on a comprehensive basis, which might serve as a centre round which men who pursued the various departments of science might rally, and communicate their ideas, and the results of their investigation to each other, and through the institute to the public.

Captain Pasley had much pleasure in seconding the proposition. He was fully conscious that the Institute they were met to found would prove of immeasurable service to the colony. There were scattered labourers in science whose results, if collected and digested by such a body, might tend to the wealth and happiness of the people. It was a constantly occurring thing, to find that the existence of a natural treasure was found by those who knew not what it was, and neither the finders nor the community reaped any benefit from it. Something of this kind had occurred in the case of the gold discoveries. The valuable tin ore was at first thrown away as valueless, then mistaken for silver, and disappointment entailed, and not until it had been subjected to scientific examination was its true value known. Wants of the colony might be supplied by the agency of the institute: for instance, there was now a great want of good building stone,—people might find stone, and remit specimens of it, and its qualities would be examined and reported on. He referred to the British Association for evidence of the advantages to be derived from such institutions.

Mr. Montefiore supported the proposition cordially. He was delighted to see and to take part in a movement for the establishment of a scientific association. Not only was there great advantage to be gained in the way of accession of wealth, but he hoped that a noble state of things would arise, in which mental culture would be duly appreciated, and refinement become a characteristic of society.

The proposition was adopted with enthusiasm.

Mr. Gibbons then moved the second clause, for the election of members, which did not require comment.

Mr. O'Brien seconded the motion, which was carried.

Mr. Gibbons, in moving the third clause, said he suggested the election of ten members of Council, four official and six non-official members. The former might be re-elected if they proved efficient, but rotation was ensured by the annual retirement of three of the non-official members. The qualification suggested for future elections to the Council might be that of usefulness to the Institute in any department,—either labour in the administration, the delivery of useful lectures or important papers, the making of valuable discoveries, or the gift of valuable specimens and objects. He had two objects in making all the offices honorary; one was to place the official and non-official members in positions of equal responsibility, and the other was to shut out the promoter from all possible pecuniary interest in the plan he proposed.

Mr. R. Woolley seconded the proposition, and expressed his assent to the views set forth by the promoter.

Mr. Bowman considered that the meeting was entering too much into detail. He would advocate the appointment of a provisional committee to discuss these matters.

Some other gentlemen expressed the same view, when

Mr. Gibbons explained that the object of proposing to elect the Council then was to prevent the risk of the undertaking falling to the ground, as business entrusted to a provisional committee too frequently did. Another clause (the seventh) would instruct the Council, if now elected, to prepare a code of rules, subject to confirmation by a general meeting. Thus the Institute would not be committed to any measures of detail, while the important condition of actual organization was given to it. The resolution merely went to make the provisional committee the same as the intended permanent one. He professed, however, a desire to ascertain the true views of the meeting, and to modify his propositions in accordance with them.

Mr. Sinnett thought, that although the details need not now be entered upon, the Institute ought to be then definitely constituted, and not exposed to the danger of falling through a provisional committee.

Several gentlemen took up this view, and various amendments were brought forward.

The resolution was ultimately carried, with the following rider :

That of this Council only the six non-official members be now elected; the same to serve until the 31st December, 1854.

Mr. Montefiore then moved, and Mr. Gibbons seconded,

That this Council be requested to prepare a constitution for the Institute, and to submit the same to a General Meeting on Saturday the 24th June.

The following gentlemen were then elected members of the Council :—

Captain Pasley, R.E.	Dr. Maund.
J. J. Moody, Esq.	F. Sinnett, Esq.
W. S. Gibbons, Esq.	A. R. C. Selwyn, Esq.

The greatest enthusiasm in the object proposed was evinced by all present, and the promoter was very well received by the meeting.

The Meeting then separated, after a vote of thanks to the Mayor, who, in acknowledging the compliment, declared that he felt it a privilege to have assisted at the inauguration of an institute of so noble a character, and likely to prove of so great advantage to the colony.

It was arranged that the Council should hold a meeting immediately, and that advertisements should be published inviting those gentlemen who might possess copies of the constitutions and rules of the British Association, the Society of Arts, or any similiar institutions, to lend them to the Council as models. Communications to be still addressed to the care of Mr. Gibbons, convener of the Council.

GENERAL MEETING,

31*st July*, 1854.

F. Sinnett, Esq., the chairman of the Council, having been called to the chair, said that the business, however, that had now to be brought forward was short. It existed merely in the question of the adoption and non-adoption of the rules that had been framed under the constitution by the Council for the government of the society, they would now be submitted to the meeting. It was also necessary to increase the number of the Council from six to ten. He had to announce to the society that his Excellency Sir Charles Hotham had been pleased to signify his consent to assume the office of Patron of the Institute. There were also some office-bearers to be elected. He would further remark that the mere passing of rules would not of necessity secure the success of the society; they would merely preserve it from confusion. The society must look for success to the individual exertions of the members themselves. It would be necessary for them to form themselves into sections, for the consideration of the various branches of science; and, fully to support the society it would be necessary for every member to take part in its proceedings. He would now call upon the Secretary to read the proposed rules, together with the various parts of the constitution on which they were based.

The Honorary Secretary having read the laws,

Captain Pasley said, in moving the adoption of these laws it would not be necessary for him to say much. They were simple in their character, short and easily understood. At the end of the year if they were not found to work well, it would be competent for the society to alter or amend them. He would, therefore, move their adoption.

Mr. Moody seconded the motion; which was put and carried.

The Chairman said that the next business for consideration would be the appointment of gentlemen to fill the various offices that were now vacant. On the voting-papers handed round there were certain names put down in connection with these offices. The council did not mention these names with the intention of dictating to the meeting; the names were mentioned merely as a suggestion that would probably save both time and trouble. It would be competent for any member to move the addition of any other name to the list, and then the ballot could be taken on the amended list.

Captain Pasley proposed the acting Chief Justice, as President of the Institute; Mr. Moody seconded the motion, which was carried.

Mr. Moody moved that Capt. Clarke, R.E., the Surveyor-General, be elected to the office of Vice-President.

Captain Pasley seconded the motion, which was carried

Mr. Moody proposed that Jacob Montefiore, Esq., be appointed Treasurer to the Institute ; carried.

After some unimportant conversational discussion, the following gentlemen were elected Members of the Council :—

E. G. Mayne, Esq., Registrar of the University.
A. K. Smith, Esq., Engineer of Gas Works.
— Harrison, Esq., C.E.
C. J. Griffiths, Esq., M.L.C.
Dr. Ferd. Mueller, Government Botanist.

The election was taken by a poll, E. Wilson, Esq., and Captain Pasley being scrutineers.

Mr. Gibbons, the Secretary, announced that the rules just passed would be printed and distributed amongst the members. He said it was intended at an early period to assemble the Institute as a *conversazione* or a *soirée*, in order to set the society fairly going before the public, when it would be expected that as many as possible would lend their co-operation to forward its interests. Many gentlemen might possess objects, the production of the Colony, that it might be desirable to bring forward. It is also expected that many of the members will address the meeting on particular subjects.

Dr. Maund said there was still one subject that he wished to bring under the notice of the meeting. It was a well-known fact that a division of labour tended much to the perfection of the mechanical arts; so, in science, a division of labour was found of the very greatest advantage. For that reason he hoped to see the society divide itself into sections, that the attention of each individual might be directed to one particular object. Otherwise it would be difficult for the society to succeed. Gentlemen would do well to bear in mind that this arrangement must proceed from themselves. Each gentleman might signify to the Secretary the particular direction in which he intended to carry on his enquiries, and by next meeting something like a system might be arranged. He did not intend to put this as a resolution, he merely meant it as a suggestion.

Mr. L. L. Smith announced that he would offer a silver medal as a prize for the best essay or lecture on any scientific object.

There being no further business before the chair the meeting separated.

INAUGURAL CONVERSAZIONE,

22nd September, 1854.

The Institute met, as usual, in the Mechanics' Institution.

The President occupied the chair, and delivered an inaugural address.

(Vide page 1.*)*

Throughout the room were ranged contributions illustrative of the objects of the Institute.

The following is an approximate list of the subjects contributed to the Exhibition :—

Bland, R. H.—Case of gold specimens, including samples from every diggings; large gold ingot, &c. Minerals of value from various parts of the Colony. Mining and surveying instruments; assay balance.

Brisbane, J.—Skull of an Australian half-caste. Engravings; fire-arms; microscope.

Clarke, Capt.—Map of the Gold Fields; pair of electrotyped plates; collection of minerals; collection of stuffed animals.

Capewell, L. P.—A collection of useful natural products of the Ballan district, viz.,—coal; gold in various conditions; limestone; building clay, pipe clay; bark; kino; amadou; gum, &c. A collection of native implements; drawings by the Aborigines; Dipleidoscope.

Campbell, W. H.—Skulls, illustrating the process of dentition, &c.

Dismorr, J. S.—Fossils; cases of shells; microscope.

Gibbons, W. S.—Philosophical apparatus, &c., including oxy-hydrogen jets, and dissolving view apparatus; microscopes; metronome; chemical apparatus; electrotype medallion; insects; microscopic preparations; physical map, drawings, &c.

Hough, G. S.—A physical atlas.

Maund, Dr.—Chemical apparatus; samples of pure chemicals; surgical apparatus and drawings; skeleton; stuffed birds; and a kangaroo.

Knight, J. G.—Prize design for Government House—architectural drawings.

Martin, W.—Davy lamp.

Montefiore, J.—Varieties of copper ore; bronzes; views in New Zealand.

Moody, J. J.—Plans for a ship canal; limestone; New Zealand weapons, &c.

Moore, J.—Model of steam ferry.

Ohlfsen, Bagge, C. H.—Model of trussed bridge; views in Holy Land.

Pasley, Capt.—Plans of proposed Government House; ditto Council Chambers.

Smith, A. K.—Model of eccentric pump; electric telegraph; limestone from Mount Eliza; arms; mathematical instruments; engineering books and plates.

Smith, L. L —Surgical instruments.
Wilson, E.—Statuette, "Dorothea"; stereoscope; madder of colonial growth; glass of colonial manufacture; minerals; microscope.

Buzzard & Vale.—Engravings; illustrated books; colonial bookbinding.
Dennis, A. C.—Statuette, "Greek Slave," &c.
Hazelden, —.—Arrowroot of colonial growth.
Hayden, H.—Hortus siccus; algæ, &c.
Hackett, —.—Gold and silver plate, of colonial manufacture.
Kent, R.—Flags of all nations.
Leith, —.—Portfolio of antique engravings.
McGowan, S.—Suite of electric telegraph apparatus, and materials used.
Mechanics' Institution.—Philosophical apparatus; statuary, &c.
Pearson, A.—Curiosities from the Cape of Good Hope.
Sprague, J. T.—Process of electro-plating; electro-magnetic coils, &c.; steam engine.
Simons, W. P.—Bronze statuette, "Wellington."
Scaife, R.—Gold tokens of colonial manufacture.
Wilson, W.—Model locomotive.

The various objects were illustrated and explained to the visitors by their owners or by those members who were versed in the particular subjects. Thus short lectures were given to succeeding groups on the following, among other subjects:—By Dr. Mueller on the plants exhibited. Mr. A. K. Smith on the locomotive engine, which was shown in action; on a new pump, &c. Mr. W. S. Gibbons on Morse's electric telegraph; microscopic exposition, &c. Dr. Maund on various chemical subjects. Mr. Moody on the proposed ship canal to Hobson's Bay. Mr. Sprague on electro-plating and electro-magnetism, &c. &c.

ORDINARY MEETING,

26th September, 1854.

Mr. Sinnett in the chair.

Mr. W. H. Archer read a paper on Statistical Sanitary Processes.

(Vide page 20.*)*

Mr. Archer laid before the Institute portions of his forthcoming Statistical Register of Victoria. He indicated, as the best way of getting accurate data on which to found measures for the preservation of public health, the division of the city into sections, and the exploration of each portion by a deputation appointed for that purpose. He hoped that the Institute would take up this question, and that the members would be found to co-operate for so desirable an end.

The Chairman remarked that the system for forming sections of the Institute provided for cases of this kind.

Mr. Mayne inquired if a comparison had been instituted between the mortality of the town and the bush.

Mr. Archer said that an inquiry of the kind was being made, but that sufficient data were not now possessed on which to form any correct conclusion, and it was of no use to put forth opinions. All comparisons of the kind must be based upon the ascertained population; now the census returns for the city of Melbourne had not yet been handed in. In reply to a question as to the decrement of life, he stated that the material was not yet complete, but that as soon as the necessary information was collected, he would prepare tables of the expectation of life.

Dr. Maund was glad that the initiation had been taken in so important a matter as the consideration of vital statistics, and hoped that the suggestion of the essayist would be acted upon.

Mr. Gibbons pointed to the sectional system as a means for carrying out investigations. By it those members who applied themselves to particular subjects would associate themselves together, and confer upon each other observations, giving the members at large the benefit of their researches. The leading divisions given in the published scheme were merely indicative; it was for the pursuit of particular sciences and arts that sections would be formed, —and, indeed, sections would only be useful for such pursuits, as a section on physical science or on natural history, for example, would be as little definite in its objects as the Institute at large. He recommended members who were willing to act on such sections for purposes of research, to register their names at once, that the sections might be set in action without delay.

Mr. Sinnett then read a paper on some personal observations on the geography of the Lake Torrens District.

(*Vide page* 15.)

Dr. Mueller promised that on some future occasion he would lay before the Institute his notes on the Flora of the district.

Mr. Lloyd inquired the prevailing causes of the failure of these exploring expeditions.

Dr. Mueller said that the want of water experienced shortly after passing the mountain range was the chief cause of failure. Conveyances broke down, and people sickened and died; but all these misfortunes were traceable to a want of water.

Mr. Sinnett said, that in the course of his travels he had seldom met with much difficulty in finding water; but on approaching the interior of the continent it became too salt for use. He traced out on the map the routes of the explorers, especially Captain Stokes, of H. M. S. *Beagle*, who had penetrated to some distance inward from the Gulf of Carpentaria, who entertained anticipations of a

large navigable river, extending one thousand miles up. Camels might, with advantage, be employed in the desert country where the ground was soft, but they could not be employed in stony country.

Dr. Mueller quoted a statement of Captain Sturt, that he had been led to believe that there was water at no great distance from the furthest point reached by him, from the circumstance that birds were constantly seen flying, as if to water, in straight lines that must have converged to a common point of intersection.

On inquiry as to the origin of the salt, which seemed to increase towards the interior of the continent, it was observed that the theory of the recent elevation of the land would account for it, as there would have been a sheet of sea-water enclosed in the area bounded by the mountain range, and this gradually evaporating and retreating to the hollow spots would explain the phenomenon.

The Secretary presented to the notice of the members an interesting collection of valuable natural productions, collected by L. P. Capewell, Esq., within a distance of six miles from his own house at Ballan. The collection included coal, limestone, granite, freestone, basalt, gold, wattle gum, kino, bark, amadon, &c.; also a collection of microscopic preparations illustrative of the scab in the sheep.

The following Sections were formed:—

Sanitary Economy.—W. H. Archer, Esq.; Dr. Maund; and A. Barrett, Esq.

Engineering.—A. Harrison, Esq.; A. K. Smith, Esq.; and F. Sinnett, Esq.

Political Economy.—E. G. Mayne, Esq.; W. H. Archer, Esq.; F. Sinnett, Esq.; T. W. Whipham, Esq.

Chemistry.—Dr. Maund; J. T. Sprague, Esq.,; and W. S. Gibbons, Esq.

Microscopic Investigation.—L. P. Capewell, Esq.; Dr. Maund; and W. S. Gibbons, Esq.

ORDINARY MEETING,

23*rd October*, 1854.

Mr. Sinnett in the chair.

Dr. Mueller laid before the Institute a paper embodying the diagnoses of fifty Australian plants, newly described and some newly discovered by the author.

(*Vide page* 28.)

The paper was illustrated by a collection of the plants described.

ORDINARY MEETING,

28th November, 1854.

Mr. Montefiore in the chair.

Dr. Maund read a paper on the Deterioration of Breadstuffs.

(*Vide page* 48.)

Mr. Jackson, C.E., promised a paper on the Plenty Water Scheme for the next meeting.

A conversation then ensued, in the course of which Mr. Jackson developed a peculiar plan for the propulsion of steamships by two screws, working in open tubes or channels placed before the beams and at on angle to the line of the keel. He also made some observations on the difference of form between the sperm whale, which travelled with amazing rapidity, and of clipper ships.

Dr. Smith urged the necessity of forming a Museum. He also suggested a plan to check the rolling of ships by the use of water-boards to strike on the surface of the water.

Some nautical gentlemen explained that many old ships had been built with such water-boards which did not answer, the shock occasioned by the blow of the boards on the wave being found to strain the ship severely, and to risk carrying away the masts.

The Secretary was instructed to call a special meeting of the Council for the purpose of taking steps for the amalgamation of the Institute with the Philosophical Society, as the existence of two separate societies caused a division of the forces which might be brought to bear upon the same subjects ; and as the colony was hardly able to support adequately two separate institutions having the same objects.

ORDINARY MEETING.

23rd December, 1854.

Dr. Maund in the chair.

Mr. M. B. Jackson read a paper on "The Water Supply of the City of Melbourne."

(*Vide page* 54.)

After the reading of the paper a discussion took place on the various topics that it suggested. The purity of the Plenty water was said to by many degrees superior to that supplied to any of the large cities of Europe.

Dr. Maund said, from analyses made by himself, he was in a position to state that fact. In the European cities eight grains was the average quantity of organic matter contained in a gallon of water; the waters of the Plenty contained but three. Several persons present said that they had never in Australia known a pool of water to become putrid by mere stagnation, and this was generally believed to be characteristic of Australian waters alone. The theory of evaporation was discussed, and Mr. Jackson said that he could not instance his experiment on that subject as conclusive. He also said that by experiment it had been established that more rain falls in Australia than England. This gave rise to a discussion on the formation of inland lakes throughout the colony, for which the geological formation of the country is particularly favourable.

Mr. Jackson then said that along the river Yarra from the present waterworks to Prince's bridge, at a distance of twelve feet below the surface of the soil, and a few yards from the river, the water found was quite salt, while that found three feet below the surface, and at the same distance from the river, was fresh.

Dr. Maund said that the waters of the Yarra itself contained much less salt than those of many other fresh water rivers. He also said that the water was much more free from organic matter when taken from near where the present waterworks are established than if taken from the neighbourhood of the bridge. This he thought was owing to the habit of washing the horses of the city in that neighbourhood. He had now in his possession two kegs of water, of about six gallons each, one taken from the Yarra, and the other from the Plenty. They had been in his possession during the last twelve months, and were now as good as the first day they were put up.

GENERAL MEETING,

8th March, 1855.

Mr. F. Sinnett in the Chair.

The Honorary Secretary read the following Report of the Council for the session ending 31st December, 1854:—

"After the first half-year's existence of the Victorian Institute, it becomes the duty of the council to lay before the members a report of the past proceedings of the body, and a view of its present position. This report is necessarily brief, as a large portion of the time to which it refers, was occupied by the work of organisation; and also for the reason that, as the advantages of the society are of a prospective character, a record of its infancy can contain little more than a sketch of the steps which have been taken to call it into existence and to render it useful. In the month of May, 1854, propositions were put forth by the present

Honorary Secretary, for the formation of a society, having for its objects the collection and dissemination of information bearing on the welfare of the colony. The invitation met with a ready response, and a list of intending supporters was soon formed. At the initiatory public meeting, held on the 5th of June, at the Mechanics' Institution, and numerously attended, a plan of the proposed association was submitted by the promoter, and resolutions were adopted which now form part of the constitution. The discussion of the remaining portions of the proposed constitution was committed to a provisional council then appointed. The same body was also entrusted with the preparation of a code of laws, which was finally adopted by a meeting of subscribers, held on the 15th July. The laws were based on observation of the working of other similar bodies, and the main principles of the British Association were held in view as a model. The whole code is now open to revision for the purpose of making any modification that may be considered necessary. On the 22nd September, an inaugural conversazione of the members and their friends was held at the Mechanics' Institution, when an opening address was read by the president, Mr. Justice Barry. An interesting collection of natural productions and works of art and industry, gathered from all available sources, was exhibited on the occasion. The models, philosophical instruments, and the specimens of the natural productions of the colony were demonstrated to the visitors by those members who had devoted attention to the particular subjects illustrated; and, in many instances, by the inventors and producers themselves. The soiree was well attended, and the success was encouraging. Since that time monthly meetings have been held in the same place, when papers have been read, and discussions have arisen on various topics connected with the objects of the Institute. The contributed papers have been as follows:—22nd September: Inaugural Address, Mr Justice Barry.—25th September: Sanitary Processes, Mr. W. H. Archer.—25th September: Description of Lake Torrens, Mr. F. Sinnett.—23rd October: Description of Fifty New Australian Plants (illustrated by specimens), Dr. F. Mueller.—27th November: Adulteration of Breadstuffs, Dr. Maund.—23rd December: Yan Yean Water Scheme, Mr. M. B. Jackson. These papers, with the present report of the council, and an abstract of the proceedings, will shortly be published for circulation among the members, forming the transactions of the Institute for the first half-year of its existence, or rather of that portion of the time in which actual operations have been carried on. The following contributions have been received: Mr. L. P. Capewell—a collection of twelve useful natural products, gathered within six miles of Ballan; Mr. J. S. Dismorr—two boxes, containing a collection of shells; Mr. J. Brisbane, a skull of an aboriginal half caste. The Council, acting on the expressed wish of the members, has opened a negotiation with the Philosophical Society, a somewhat similar association, with a view to combine the strength of the two bodies, under the belief that one institute acting comprehensively would be more useful, and therefore more successful, than two societies having divided forces, and weakened by apparent if not real rivalry. The project for amalgamation has, however, been received somewhat coldly by the members of the sister society. The treasurer, Mr. Montefiore, having left the Colony, it is necessary to appoint his successor, to whom the secretary, who has acted as treasurer provisionally, may transfer the books and the balance in hand. It is also necessary to appoint auditors of the accounts. The number of members on the books at the close of the year was seventy-nine. Some few of these have, however, left the Colony.

An abstract statement of the cash account brought down to the 28th February is appended to this report.

The (Acting) Treasurer in account with the Victorian Institute:—

Dr.	£	*s.*	*d.*
To Subscriptions	172	4	0
Conversazione Tickets	14	5	0
Do. Council Subscription	26	7	6
	£212	16	6

Cr.	£	*s.*	*d.*
By Rent	17	17	0
Advertising	17	12	0
Stationery	3	13	0
Printing	33	8	0
Conversazione	65	0	5
Postage	6	16	8
Balance in hand	68	9	5
	£212	16	6
Balance in hand 28th February, 1855	68	9	5

WM. SYDNEY GIBBONS, *Hon. Sec.*

Mr. Crawford moved; Mr. Barrett seconded—"That this report be adopted." Carried.

Mr. Gibbons moved; Mr. Clarson seconded—"That Dr. Maund be elected Treasurer, *vice* Mr. Montefiore, resigned." Carried.

A discussion took place on the advisability of reducing the subscription to the Institute for the current year, and on the amount to which it should be reduced. The following amounts were moved:—

By Mr. Barrett	£3	3	0
,, Crawford	2	2	0
,, Kentish	1	1	0

The proposition of Mr. Crawford was adopted, viz.:—"That the subscription to the Institute for the current year, in one payment, be fixed at one half of that quoted in the rules, viz., two guineas for ordinary members, and one guinea for country members."

Mr. Crawford moved; Mr. Kentish seconded—"That the secretary be instructed to reply to the letter of the Secretary of the Philosophical Society, that, as a general principle, in the event of the amalgamation of the two societies, the members' and subscription lists be united, and that the moneys in hand be made a common fund; and that details be arranged by a conference of the councils of the two societies."

Mr. Gibbons moved as an amendment the addition of the works:—"The following points being observed, viz.,—that either the double name be preserved, or a new and distinctive one be adopted; and that the two councils, as at present constituted, form a united body. The amount of subscription and other minor details to be settled by the conference." The motion was carried with the addition.

Mr. Kentish moved; Mr. F. Bell seconded—"That the chairman of council be requested to write to the president of the Philosophical So-

ciety, stating that the Victorian Institute deems it due to W. S. Gibbons, Esq., that he should retain office as joint secretary in the event of the amalgamation of the two societies, and that this proviso will be deemed an essential condition to amalgamation." Carried.

On the motion of Mr. Gibbons, Messrs. Barrett & Clarson were elected auditors. Mr. E. Richardson, Palmer Street, Collingwood, was admitted a member.

The Secretary announced that the ordinary meetings of the Institute would thenceforward be held in the Mechanics' Institution, on the evenings of the first Thursdays of each month, at 8 o'clock, P.M.; and the council meetings on the preceding Thursdays, viz., the last in the month at half-past 4, P.M.

ORDINARY MEETING,

Thursday, 5th April, 1855.

Dr. F. Mueller in the chair.

Mr. E. G. Mayne read a paper of "Observations on a National Loan for Victoria, with reference to the state of labor in the Colony."

(*Vide page* 61.)

Dr. Mueller read a paper "On some species of Solanum, found by him in Gipps' Land *(solanum vescum)*.

(*Vide page* 67.)

Dr. Maund gave an account of an "Aërated acidulous spring at Hepburn, and of another on the Merri Creek;" "and exhibited a specimen of native Sulphate of Soda found crystallised in natural cavities at Anderson's Creek."

Mr. A. K. Smith reported that the native sulphuret of antimony, found by Mr. Kinsella at McIvor, had realised £45 in England; and that the shipments of black sand from the Ovens had fetched £117 per ton, chiefly on account of the gold contained in it.

Dr. Maund said there was doubt, however, if it would now pay to ship the antimony, owing to the high rate of cartage from the interior.

The following members promised papers for the May meeting:—Messrs. Sinnett, Clarson, Maund, Smith, Holmes, and Gibbons.

Dr. Maund was requested to commit to writing his observations on the mineral waters.

(*Vide page* 70.)

Dr. Maund stated that he had received a sample of cinnabar, said to have been found in the Colony, but he had lost sight of the person who furnished it, and was not possessed of evidence on the subject.

ORDINARY MEETING,

Thursday, 3rd May, 1855.

Mr. E. G. Mayne in the chair.

Mr. Sinnett, Chairman of the Amalgamation Conference, read the following report, and stated that if it were adopted by both societies, the amalgamation might be at once proceeded with.

Report.

The members of the Philosophical Society and of the Victorian Institute, appointed to confer upon terms of amalgamation of the two bodies have the honour to report to their respective societies as follows:—

They have held four meetings, have considered the fundamental principles and present position of the two societies, and find no impediment to amalgamation. They accordingly recommend—

That the two societies be amalgamated, under the title, pending the grant of a royal charter, of "The Philosophical Institute of Victoria."

That the following gentlemen be office-bearers of the Philosophical Institute of Victoria:—President, Captain Clarke, R.E.; vice-presidents, his Honor Mr. Justice Barry and Godfrey Howitt, Esq., M.D.; council, the present members of the council of the Philosophical Society and of the Victorian Institute; treasurer, D. E. Wilkie, Esq., M.D.; honorary secretaries, S. Wekey, Esq., R. B. Smyth, Esq., W. S. Gibbons, Esq.

That the members of the Philosophical Institute of Victoria shall consist of fellows, resident and honorary members. That fellows shall be elected from among the resident members by ballot, at the monthly meetings of the society; the proportion of votes for deciding the election of fellows to be at least four-fifths of the members voting. That resident members be admitted on application to, and approval by the council.

That honorary membership shall be considered one of the highest marks of distinction the society can confer.

That the objects of the Philosophical Institute shall be as stated in the prospectus of the Philosophical Society, viz.:—The objects of the society shall embrace the whole field of science, with a special reference to the cultivation of those departments that are calculated to develope the natural resources of the country.

That the mode of operation stated in the prospectus of the Philosophical Society be adopted, with some addition, viz.:—The objects of the society will be carried out by original researches conducted by the members, and by original papers, to be read at the periodical meetings, and published under the direction of the society; and by such other means as may be deemed expedient.

That the principle set forth in the paragraph headed "Bye laws and Regulations," in the prospectus of the Philosophical Society, viz.:—"The society shall be definitely established on the principle of the Royal Society of London, as far as the existing bye-laws and regulations of that Society may be applicable to the present local circumstances of Victoria,"—be rejected, inasmuch as the regulations of the Royal Society of London forbid the discussion of papers read at general meetings,—

such discussion being deemed desirable, and forming an essential part of the scheme of the Victorian Institute. That bye-laws and regulations be therefore framed hereafter by the Philosophical Institute.

That with regard to the property of the society, the specimens of natural history contributed to the society shall be considered the property of the National Museum until otherwise ordered and resolved by the annual general meeting of the society.

That the resolution of the annual general meeting, shall not extend to those specimens that are found in actual possession of the society at the time of such resolution being brought in, such specimens being already the property of the National Museum; but merely to such specimens as may be collected after the date of the said resolution being made.

That every paper, plan, model, &c., presented to the society shall be considered the property thereof, unless there shall have been made some previous arrangements with the donor; and the council may publish such paper, and a description of such plan or model, any time they think proper.

No member shall publish on his own account, or give his consent for publication of, any written communication read to the society, without the previous consent of the council.

These recommendations are based on the four paragraphs headed "The Property of the Society," in the prospectus of the Philosophical Society. Some alterations, however, it will be seen have been made, because it was not deemed desirable that models and books presented to the society should pass out of their hands, because the first of these paragraphs, literally interpreted, would deprive the society of all property whatsoever, even in their own transactions, and because such interpretation contradicts the third paragraph, which has been adopted verbatim.

That the subscriptions at present payable by the members of the Philosophical Society and of the Victorian Institute respectively, be considered the subscriptions due to the Philosophical Society of Victoria for the current year, after which the subscription to the Philosophical Institute can be fixed by that body.

In recommending that the Victorian Institute and Philosophical Society be amalgamated on the above general terms, the fact has been borne in mind that, after amalgamation, these terms would be subject to complete revision by the Philosophical Institute, and that all details can be most properly adjusted by general vote of the united body. In conclusion, therefore, the members of the conference appointed to consider the terms of the proposed amalgamation, strongly recommend that to bring about that desirable end, minor objections should be waived and concessions freely made on both sides, as such concessions will merely be required to permit the preliminary difficulties to be overcome, and will not be permanent unless hereafter approved by the members of the Philosophical Institute of Victoria.

FRED. SINNETT, CHAIRMAN.

Mr. Sinnett moved; Dr. Mueller seconded—That the report of the conference be adopted. Carried.

The chairman called on Mr. Sinnett for his paper on Australian Exploration, who said that it would not be ready until the next meeting.

The secretary read letters from the agents of the Magnetic Telegraph Company, enclosing prospectuses of the patent, which he was instructed to answer, expressing the willingness of the Institute to render any assistance in its power toward bringing the invention into notice.

Dr. Maund read a paper "On the Purity of the Water of the Plenty," and exhibited samples of that and other water taken and preserved under different circumstances.

(Vide page 136.*)*

Mr. Sinnett inquired the causes of the deterioration of water?

Mr. Barrett asked how it was that the Thames water, after putrefying, became sweet again?

Mr. Mayne asked what pipe was recommended for the service of water, as the water of the Plenty was shown to take up so much lead?

Dr. Maund replied that water became unfit for use owing to the decomposition of the organic matter suspended in it. The putrefaction and subsequent sweetening of Thames water was attributable to the fermentation of the organic matter, which subsided when that process was complete. By a new invention, iron pipes received a lining of a bituminous character, somewhat like japan, which prevented corrosion; moreover the presence of iron in water was not injurious.

Mr. A. K. Smith read a paper "On Gas and Gas-works, considered in relation to the circumstances and requirements of the Colony."

(Vide page 143.*)*

Mr. E. G. Mayne inquired if the coal of New South Wales would not do for the manufacture of gas?

Mr. Smith stated that the Newcastle coal did not possess a sufficient illuminative quality; it was too impure. The Boghead cannel coal produced thirty-eight units of gas, while some others, as that of New South Wales, produced only ten, its value was therefore to the other as 10·38; so that the English coal was cheaper at £6 per ton, at which price it could be laid down, than the New South Wales would be if delivered free. The Western Port coal was shown by analysis to be better than that from New South Wales; the amount of sulphur was less than in the English. If the Western Port coal field were opened, it might be used advantageously. The consumption of the gas company would amount to from fifty to sixty thousand tons annually.

Mr. Sinnett inquired what proportion the quantity of coal used for fuel to heat the retorts, bore to that used for gas.

Mr. Smith said that the residuary coke from the retorts was more than sufficient for heating, and left a portion for sale. As the company contemplated supplying the market with coke, it was intended to use a mixture of Scotch cannel and English Coal, as the coke from the Scotch coal was valueless. There were some lamps now in Melbourne that gave a light equal to gas, but the gas would be cheaper and more generally diffused.

Mr. Clarson read a paper "On the Rationale of Phonetic Representation of Language."

(Vide page 92.*)*

Mr. Richardson asked if the Phonetic system was taught in any schools?

Mr. Clarson replied that it was taught in some schools, both in England and America; that some periodicals were published in the dialect in both countries, and that the Mormons had adopted it and employed it in the publication of a newspaper. He exhibited a work containing specimens of all-known varieties of stenography, from the earliest ages.

Mr. Richardson, in the absence of Mr. Holmes the author, read a paper "On the Timber of Victoria;" and stated that Mr. Holmes contemplated a series of experiments on the relative strength of the several woods, but that he had not been able to carry them out in time for the present meeting. It was a peculiar circumstance that the woods of New Zealand shrank longitudinally, an unusual thing in England.

(Vide page 100.*)*

Mr. Mueller explained that this was due to the large amount of extractive matter. Trees for timber should be felled at the end of summer, and not when the sap was rising.

Mr. Richardson said that some Kaurie pine, used by him, had shrunk on fresh cuts being made after it had been felled two years. The weight of colonial woods was an objection to them as well as their shrinking. Some of the colonial woods had been tested in England for durability; the Kaurie pine stood the test. Some of the woods, so tested, had stood for fifty years.

Mr. Brisbane had seen a fence of Tatara wood that had stood twelve years, and also trees that had lain across creeks, beyond memory, without change. If wood were cut when the sap was down, it was not so durable, although the shrinking was avoided.

Mr. Smith said that the British Navy Board had rejected woods that were not cut in accordance with the conditions indicated by Dr. Mueller. A gentleman was going to England from Van Diemen's Land to introduce the eucalypti of that Colony into notice, and to endeavour to negociate for the supply of them. Some ships built in Van Diemen's Land long since were good now.

Mr. Brisbane instanced the case of a ship built in Van Diemen's Land, which at first leaked, and required several successive caulkings, but after a while tightened up and stood well.

Mr. Gibbons read a paper "On Microscopic Investigation, and some minor details of Manipulation."

(Vide page 104.*)*

He produced specimens to illustrate the processes described, and exhibited, under an Oberhauser microscope, preparations in support of his observations on the value of microscopic study; and specimens illustrating the modes of operation described in the paper.

The following new members were admitted:—Mr. John Edwards, Swanston Street; Mr. Thomas Rawlinson, C.E., Gore Street.

ORDINARY MEETING.

Thursday, 7th June, 1855.

Dr. Maund in the chair.

The minutes having been read and confirmed.

Dr. Mueller produced a collection of plants, most of them tending to illustrate the Flora of the country round Lake Torrens, which had been previously described by Mr. Sinnett. The collection included many new plants indigenous to the colony of Victoria.

(*Vide page* 114.)

In the course of the subsequent conversation and discussion on the collection exhibited, Dr. Mueller made the following observations: He had already travelled six thousand miles, and he had a large extent of country yet to explore, particularly about the district of Cape Otway, where he expected to collate some valuable particulars concerning the geography of some of the plants. He hoped during his next exploratory tour to be able to collect all his *materiel*, for which purpose he had still about three thousand miles to traverse. He had already prepared written descriptions of some of the botanical specimens which he exhibited, and they were at the service of the Institute should they be considered acceptable. Certain species of these plants were limited to granite localities, and others again were confined to limestone districts

Mr. A. K. Smith then read the concluding part of his paper on Gas Works, commenced at a former meeting. He described the arrangements of the Melbourne Gas Works, and the general arrangements for supplying the city with light.

(*Vide page* 143.)

Mr. A. K. Smith stated, in reply to inquiries, that a sample of apparently good cannel coal had been forwarded from New South Wales, but as it had not been analysed, he would lay the results before the next meeting, and with them, for comparison, a sample of Boghead cannel coal, a cargo of which had just arrived from Scotland for the Gas Company. The city would probably be lighted with gas in about six months' time. The chimney-stalk was of such a height as to carry off all the deleterious fumes arising from the manufacture, without occasioning any nuisance. The stalk was 190 feet in height, and the draught was calculated for sixty fires; there was no escape below for deleterious fumes.

Mr. Rawlinson suggested that the waste of the slaughter-houses and boiling-down establishments might be made available for the production of gas.

Mr. Smith said that this subject was entertained in his forthcoming paper on Stearine.

Mention having been made of oil gas, as compared with that made from coal,

Mr. Gibbons observed, that the gas produced from oil, was, *cæteris paribus*, economical, and gave a superior light: it was easily manufactured, and so was eminently calculated for private establishments, factories, &c., where a daily supply could be made, and there was no necessity for storage. But in lighting a town it was necessary

to have a large reserve in store, and the oil gas and that made from most of the hydrocarbons rapidly deteriorated. The additional illuminating power of these gases was due to the presence of a large pro portion of undecomposed hydrocarbon, which, being vapourised, remained in suspension in the gas for a sufficient time to be available for combustion, if the consumption were rapid; but if the gas was stored longer than from day to day this was all deposited in the form of an oily liquid on the surface of the water in the gas holder and even in the pipes, and the consequence was such a loss of illuminative power, that a loss rather than an advantage was the result.

Mr. Richardson read a paper "On the Trussed Bridge at Keilor."

(*Vide page* 149.)

Mr. Richardson stated in the course of the conversation, that the Bridge was completed in April 1854. The Bridge cost £11,000, and the whole work of crossing might be put down at £20,000. When the work was commenced, the only suitable timber that could be obtained was four large pine logs; the material had been collected from all sources, chiefly from New Zealand.

Mr. Rawlinson referring to the accident of the falling down of the large truss, expressed his opinion that the leading guys were too taut, and that the workmen in charge, slackened them too suddenly, so that the tackle became unhooked by re-action; a similar accident had occurred at Liverpool.

Mr. Richardson said that five men were under the truss when it fell, and they escaped by passing through the apertures. Kaurie pine had the same property as English oak of shrinking whenever it was cut, even although it had been previously seasoned.

Mr. Francis Bell read a paper "On Iron Lattice Bridges."

(*Vide page* 154.)

Mr. Bell quoted some Bridges that had been erected on this plan. One of 50 feet span, weighed 18 tons, and cost only £50 per ton, when erected. It was put together on the bank, and run over the piers on rollers. A foot bridge of 84 feet span, weighed only 6½ tons; this was on a railway near Cork. A plan was shewn of a Bridge a quarter of a mile long, with a swivel in the middle, also of an ornamental foot bridge over the Cork and Passage Railway, with spiral staircase. These bridges were cheap and very durable.

Mr. Richardson remarked that the American engineers seemed to object to iron lattice bridges, but they applied the same principle to their wooden bridges. The iron had the advantage of being fireproof.

Mr. Rawlinson approved these bridges as being both light and strong; but he objected to the ordinary sheer of the rivets, the bars needing shoes to support the strain—much strength was lost by the strain laid on the rivets. This was the point of failure in most lattice bridges. Engineers were hardly yet resolved on the best plan. Two large latticed viaducts had been erected on the railway line between Liverpool and Bury. He considered that engineers and artists wrought too independently of each other; all materials were in the hands of men of taste, capable of elegant forms.

Mr. Bell advanced a plan for widening Princes' Bridge, by throwing the whole present thoroughfare into the carriage way and erecting light iron balconies of lattice work for the footways. This had been done successfully to Dumbarton Bridge.

Mr. W. S. Gibbons read a paper "On Translation of Languages."

(Vide page 157.*)*

Mr. A. K. Smith read a paper "On the Manufacture of Stearine."

(Vide page 162.*)*

Dr. Maund produced a sample of cinnabar, which had been handed to him as having been found in the Colony; but he was not informed of the locality. He also showed a small portion of mercury that had been sublimed from the ore, which was very rich.

Mr Barrett proposed as a member Mr. Wriothesley Baptist Noel, of Kilmore.

The Secretary presented an account for £14 12*s*., due to the Mechanics' Institution for rent, which was passed.

MELBOURNE:
Goodhugh & Trembath, 48, *Flinders Lane, East.*

PROSPECTUS

OF THE

PHILOSOPHICAL SOCIETY

OF

VICTORIA,

TO BE INCORPORATED BY ROYAL CHARTER.

NATIONAL MUSEUM MELBOURNE

MELBOURNE:
GOODHUGH & TREMBATH, PRINTERS, 174, ELIZABETH STREET.
1854.

PATRON

HIS EXCELLENCY THE LIEUTENANT GOVERNOR.

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(Pro tem.)

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PROSPECTUS

OF THE

PHILOSOPHICAL SOCIETY

OF

VICTORIA,

TO BE INCORPORATED BY ROYAL CHARTER

After the grant of the Charter, this Society shall assume the title of *The Royal Society of Victoria.*

Object.

The objects of the Society shall embrace the whole field of Science, with a special reference to the cultivation of those departments that are calculated to develope the natural resources of the country.

Mode of Operation.

The objects of the Society will be carried out by original researches conducted by the members, and by original papers to be read at the periodical meetings and published under the direction of the Society.

Bye-Laws and Regulations.

The Society shall be definitively established on the principle of the Royal Society of London, as far as

the existing bye-laws and regulations of that Society may be applicable to the present local circumstances of Victoria.

Members.

The Members of the Society shall consist of *Fellows*, *Ordinary*, and *Honorary Members*.

Fellows shall be elected from among the ordinary Members at the monthly meetings of the Society.

The election to take place always by ballot.

The proportion of votes for deciding the election of Fellows will be at least *four-fifths* of the Members voting.

Ordinary Members will be admitted on application to the Council.

Honorary Membership will be considered one of the highest marks of distinction this Society can confer.

Office-Bearers.

The Office-bearers of the Society shall consist of a President, one or more Vice-Presidents, Treasurer, and Secretary; all of them to be elected annually, at the anniversary general meeting of the Society.

Management.

The power of management of the affairs of the Society shall be vested in the President, Vice-Presidents, and the Council.

The Council to consist of the Office-bearers and *eight* other Members, to be elected at the anniversary general meeting from among the *Fellows* of the Society.

Until the next anniversary meeting in 1855, the following gentlemen have been elected to act as Council Members:—The Rev. A. Morison, A. Selwyn, Esq., Dr. F. Mueller, J. Hutchinson, Esq., M. D., Dr. R. Eades, M. B., S. Iffla, Esq., M. D., F. C. Christy, Esq., M. D. W. Blandowsky, Esq.

Meetings.

The anniversary general meeting of the Society will be held on the Second Saturday of January, at *eight* o'clock P. M.

The ordinary monthly meetings on the Second Saturday of each month, at *seven* o'clock P. M.

Council meetings will be held on the *first* and *third* Wednesday of each month, at *five* o'clock P. M. *three* Members present shall constitute a *quorum*.

The Property of the Society.

The effects of the Society in Books, Specimens, Models, of what kind soever, shall be considered the property of the National Museum until otherwise ordered and resolved by the annual general meeting of the Society.

The resolution of the annual general meeting, however, shall not extend to those effects that

are found in actual possession of the Society at the time of such resolution being brought in, such effects being already the property of the National Museum; but merely to such property as may be collected after the date of the said resolution being made.

Every Paper, Plan, Model, &c., presented to the Society shall be considered the property thereof, unless there shall have been made some previous arrangement with the donor; and the Council may publish such Paper and a description of such Plan or Model any time they think proper.

No Member shall publish on his own account, or give his consent for publication of, any Communication or description of Plan or Model presented and belonging to the Society, without the previous consent of the Council.

NATIONAL MUSEUM MELBOURNE

Contribution to the Funds.

Each Member shall have to pay *three guineas* for the present year, without any entrance fee.

After the first of January, 1855, there will be an entrance fee of *two guineas*.

Admission of Members.

Application for admission to be made to the Council, addressed to the Honorary Secretary, and directed to the Museum of Natural History, Melbourne.

Goodhugh & Trembath, Printers, Elizabeth Street, and Flinders lane, East.